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INNOVATING THE STANDARD PROCUREMENT SYSTEM UTILIZING INTELLIGENT AGENT TECHNOLOGIES

by

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This thesis analyzes the innovation of the Department of Defense (DoD) standard acquisition process with intelligent agent (IA) technologies. Information technology (IT) developments are enabling DoD to seek high levels of improvement in key processes, such as acquisition, because of constrained resources, high costs and long cycle times. One such process, DoD's paperless contracting initiative, is developed to increase efficiency through automation and standardization, using the Standard Procurement System (SPS). However, benefits to date from implementing SPS have been marginal, because it has been accomplished without first redesigning the existing inefficient process. This research builds upon prior work with procurement, process innovation and intelligent software agents. Following Davenport's process-innovation methodology, the Federal acquisition process (FAP) is compared with SPS functions to identify functions for possible IT innovation with IA. A four-step scheme for evaluating agent potential is developed and employed to assess the SPS-supported FAP, resulting in the identification of nine process steps offering high potential for IA automation. Two redesign prototypes are developed to incorporate these IA candidates. This work leads to a number of conclusions, recommendations and an agenda for further research that should be an interest to the acquisition manager as well as the information system designer.

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INNOVATING THE STANDARD PROCUREMENT SYSTEM WITH INTELLIGENT AGENT TECHNOLOGIES

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This thesis analyzes the innovation of the Department of Defense (DoD) standard acquisition process with intelligent agent (IA) technologies. Information technology (IT) developments are enabling DoD to seek high levels of improvement in key processes, such as acquisition, because of constrained resources, high costs and long cycle times. One such process, DoD's paperless contracting initiative, is developed to increase efficiency through automation and standardization, using the Standard Procurement System (SPS). However, benefits to date from implementing SPS have been marginal, because it has been accomplished without first redesigning the existing inefficient process. This research builds upon prior work with procurement, process innovation and intelligent software agents. Following Davenport's process-innovation methodology, the Federal acquisition process (FAP) is compared with SPS functions to identify functions for possible IT innovation with IA. A four-step scheme for evaluating agent potential is developed and employed to assess the SPS-supported FAP, resulting in the identification of nine process steps offering high potential for IA automation. Two redesign prototypes are developed to incorporate these IA candidates. This work leads to a number of conclusions, recommendations and an agenda for further research that should be an interest to the acquisition manager as well as the information system designer.

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I. INTRODUCTION

A. BACKGROUND

1. Acquisition Reform

Acquisition reform has taken on many forms in Government procurement over the past decades. The main reason for this movement was, and is today, to become better and smarter stewards of vital resources. In the early Nineties, the Defense budget was significantly decreased and is barely keeping up with inflation. At the same time, the mission of the Department of Defense (DoD) has become more complex and is greatly expanding. This serious dilemma of trying "to do more with less" has permeated the Government environment.

Rapid advancements in information technology (IT) during these years have allowed pursuing greater levels of improvement in many critical processes. The U.S. Government procurement process is a logical candidate for using IT for such improvement because of its high cost and time-intensive nature. The reform acts of the Nineties have opened the door for electronic commerce-based measures as formalized by the DoD year 2000 paper-less acquisition goal. [Ref. 1:p. 100] In 1995 the DoD announced the acquisition of the Standard Procurement System (SPS), a comprehensive plan designed to standardize all procurement functions. [Ref. 2: p. 5] In order to be paper-free by the January 2000 requirement, the SPS contract was awarded in April 1997 to increase efficiency by automating and standardizing key elements of the procurement process. The software developed to meet the SPS requirement is called Procurement

Desktop-Defense (PD^2). However, despite this progress, the SPS initiative has not been without its problems.

> SPS represents a significant step forward to overcome many of the severe pathologies associated with the procurement process. However, a number of problems are emerging in conjunction with SPS implementation, and it clearly represents only a humble beginning to advancing the state of the art in electronic contracting. (The) next generations of IT, incorporating AI (artificial intelligence) technologies, offer potential to dramatically reduce both cost and cycle time of procurement processes. [Ref. 3:p. 1]

There are two major obstacles to the efficient, effective implementation and utilization of SPS. First of all, the Federal procurement process is a dynamic and complex process, which is comprised of many players using different automated systems. The Government's primary solution to standardize these automated systems is SPS. But SPS is similarly a detailed and complicated system that is difficult to employ. The second obstacle is cost. Not only are there enormous start-up costs to install hardware and purchase licenses, but there are on-going labor-based costs, like training and upgrades. Because people are the common critical element to both of these obstacles, it is paramount that management focuses on the development of the SPS user. Personnel must take the time to learn, to teach and to practice this new, intricate system.

These major obstacles, along with many initial software problems, have delayed the implementation of SPS. DoD was originally scheduled to have SPS operational by January 2000, commensurate with the paper-free goal. [Ref. 1:p. 100] Many offices are already over-tasked, under-staffed and find it very difficult to prioritize SPS above other activities. There is understandably some resistance to learn SPS because a significant

portion of the workforce does not have the requisite intermediate IT skills. Job security, apathy and even fear are also commonplace in many procurement offices. Regardless of these notions, DoD is committed to implementation of SPS and has expended $59 million since its award in 1997. [Ref. 4:p. 1]

SPS uses IT functions like word processing, spreadsheet, document management, arithmetic solver, relational database, network and decision support functions to enhance the performance by automating routine operations. Many managers and users have underutilized some of these current tools, and SPS performance could be increased with a better understanding of how they work. [Ref. 5] In fact, with more use of advanced IT, SPS productivity and application can be greatly enhanced by empowering the machine and enabling the user to do less of the routine functions.

2. Present Technology

The growth of the technology sector is like a two-edged sword. There is great potential to leverage this technology and make substantial gains. But it is absurd to think that automating with IT is the solution in itself. The implementation of IT can actually diminish productivity and create more problems, especially in its initial stages. [Ref. 6:p. 5] Not only this, but hardware and software systems become obsolete quickly and resultant costs can be high.

The future technology that the Government can employ is already present in the commercial sector. Intelligent Agent (IA) technology is utilized throughout the Internet in search engines to conduct continual data filters, searches and retrieval, as well as in commercial firms like hospitals and automobile production plants. Today's expert

systems and more advanced agent applications perform complex decisions in numerous commercial applications, including electronic commerce (EC). The application and means of this technology continually progresses.

Why not use this cutting edge technology in acquisition reform? Research is being conducted to use IA technology to create performative models in expert systems to reengineer the Federal procurement process. Such systems could make the majority of acquisition decisions and actions, and increase productivity if it can overcome these significant obstacles. [Ref. 7:p. 8]

3. The Future and "SPS Plus"

As a Government acquisition professional and a taxpayer, one should focus on how to better utilize SPS and not dwell on its flaws and imperfections. As Major Teresa McCarthy states in her Naval Postgraduate School thesis "Innovating the Standard Procurement Process" [Ref. 6], SPS, despite its limitations, is at least a bold and significant step in the right direction. By using IA technology to innovate SPS, more labor hours could be allocated to managing and making higher decisions rather than performing routine actions that the computer can be programmed to perform.

The good news is that SPS is being implemented through an incremental strategy and future versions will incorporate more features and enhancements. [Ref. 8] IA technologies can be utilized to produce structured incremental additions to these future SPS versions. This thesis suggests identifying, analyzing, and formulating such IA technology improvements to the key functions of SPS. Beyond these incremental changes, these innovations can also be the framework for the redesigning of an entirely

new version of SPS, five to ten years from now that incorporates extensive use of IA technologies. The researcher calls this future system "SPS Plus."

B. OBJECTIVES

This thesis discusses, proposes and formulates performance enhancements of SPS using IA technologies. It examines and details the major functions of the Federal procurement process and analyzes potential IA technology improvements. The researcher proposes a completely innovative model, "SPS Plus," which pushes the technology and the acquisition reform envelopes to initiate momentum for future research and innovation of the entire Federal procurement process.

C. RESEARCH QUESTIONS

This research focuses on the following questions:

1. Primary

How can Intelligent Agent (IA) technologies be used to innovate and enhance the performance of the Standard Procurement System (SPS)?

2. Secondary

- What are the critical functions of the U.S. Government's standard procurement process?
- What are the critical functions of the Standard Procurement System (SPS)?

- Are the critical functions of SPS accomplished using manual or automated IT means?

- What specific Intelligent Agent (IA) technologies can be utilized to enhance the key functions of SPS?

- What limitations exist that hinder the efficient and effective enabling of SPS with IA technology?

- How can the entire Federal procurement system be reengineered using IA technology?

D. SCOPE, LIMITATIONS AND ASSUMPTIONS

1. Scope

This thesis focuses on deriving innovative functional enhancements to SPS utilizing IA. It uses data from the SPS contractors and SPS users to aid in identifying, analyzing, and formulating advanced, automated improvements. Based on these findings, this thesis makes recommendations on how to improve the productivity of the SPS application with additional IA technologies. This thesis does not list and propose solutions to current problems with SPS unless they relate to IA innovations.

The Government's acquisition process is very comprehensive and complex in nature. In order to conduct a focused analysis, the research will narrow the analysis to commercial acquisitions above the micro-purchase threshold and below the major system level. The research also focuses on commercial items rather than standard stock items for

two reasons. First, standard stock items are generally more straightforward to procure because of their historical, recurring demand and unique stock number attributes. Second, there is a current and momentous trend to benchmark non-government industry's best practices by procuring more commercial items. [Ref. 8:p. 22] The analysis model of this thesis does not include micro-purchases or major systems, which functions the current SPS version 4.1 does not perform.

The researcher also limits the examination to product-based acquisitions; construction, research and development (R&D), test and evaluation, and service contracts are not included in the model. This research does not include the sealed bid method. In addition, the researcher only examines and proposes innovations to the critical and major functions of the entire acquisition cycle. Amongst the many minor functions of the acquisition cycle, there are numerous potential applications for IA. Under this "SPS Plus" model, a majority of the more common and SPS-capable applications are addressed.

2. Limitations

In order to build upon previous documentation, the researcher does not propose a complete reengineering of the entire Federal procurement process. This thesis only discusses significant yet radical IA enhancements to the SPS model. This thesis is limited to the perspective of the acquisition manager and not of that the software engineer. Recommendations are made for future research to explore the detailed code and/or hardware changes that would be required to make these improvements. This analysis is also limited to a more theoretical approach as IA technology and SPS are both in relative early stages of application. As previously stated, the research model used is

limited to a microcosm of common, SPS-based, U.S. Navy procurement actions involving commercial items between the micro-purchase and large purchase thresholds.

3. Assumptions

The first major assumption is that a software engineer has the ability to code all the proposed innovations that the IA technology will perform. It is assumed that future IT innovations will allow for quantum increases in hardware like bandwidth, security, processor speed, common languages and memory. This type of radical progression is required to accomplish these improvements to overcome speed and capacity limitations that currently limit existing systems. All of these proposed individual innovations, at some time in the near future, will be able to be integrated throughout the "SPS Plus" model. Without these assumptions, these innovations would be too expensive and too time consuming to implement in today's environment. The vision of the proposed "SPS Plus" model is that it will be available in five to ten years, when these assumptions will more than likely be achievable.

The audience for this thesis includes policy makers, acquisition professionals and future authors of the next generation of SPS. It is assumed that all have a basic knowledge of the acquisition and IT fields. Because there are numerous acquisition and IT terms applicable to this thesis, a separate list is presented in Appendix A. Finally, current laws and organizational structure will allow for this radical type of innovation to occur. The researcher refers to SPS throughout this thesis, which encompasses not only SPS but also PD^2, the software application responsible for executing SPS functions.

E. RESEARCH METHODOLOGY

This thesis builds upon McCarthy's Naval Postgraduate School thesis entitled "Innovating the Standard Procurement Process." [Ref. 6] McCarthy used the Davenport model [Ref. 9], which is a deductive approach to process innovation. This model gathered, grouped and analyzed key SPS functions and made recommendations to enhance productivity based on its findings.

This thesis takes McCarthy's analysis of innovating SPS one step further by proposing enabling IA technology into critical SPS processes. Data are collected via literature reviews, interviews, and site visits to contracting offices that are employing the SPS. Such literature includes current publications, Internet sites, manuals, periodicals, Federal regulations and previous theses. Interviews are conducted with knowledgeable contracting and acquisition professionals that have experience with SPS and IT. These methods are used to improve DoD 's current standard procurement system.

F. BENEFITS OF RESEARCH

This thesis will benefit the researcher by providing a comprehensive understanding of the Government's standard procurement process and SPS. It will potentially initiate DoD-wide instruments to enhance the current performance and innovation of SPS versions. Finally, this thesis will recommend further research to radically redesign and improve the standard procurement system with IA technologies.

G. ORGANIZATION OF THESIS

The organization of this thesis follows this introduction with a background chapter. Chapter III explains the methodology and presentation of data and Chapter IV details the innovating of SPS using IA technologies. Chapter V summarizes with conclusions, recommendation and areas of further research. Appendix A lists essential terminology unique to IT and acquisition. Appendix B lists the detailed functionality of SPS.

II. BACKGROUND

A. GENERAL

Our Government has used a variety of methods to acquire goods and services over the past two centuries, ranging from simple verbal agreements sealed with a handshake to sophisticated major weapon system programs, some taking months and even years to award. Historical events like procurement scandals, shrinking budgets and technological advances have been the impetus for numerous acquisition reform measures. These forces continue to shape this basic procurement process.

This chapter describes an overview of procurement in its most basic form, followed by the environment and key issues associated with the Federal procurement process. The chapter also depicts the Federal Acquisition Process (FAP) and the Standard Procurement System (SPS) (e.g., Procurement Desktop-Defense {PD^2}) to give further context for understanding the innovation process. The chapter concludes with a synopsis of intelligent agent (IA) technology and the process reengineering model.

1. Basic Procurement

The basic acquisition process is as applicable to individuals and households as it is to major corporations and government agencies. In its most basic form, *purchasing* refers to satisfying one's needs through exchanging something of value for supplies or services [Ref. 6:p. 13], and this term is defined in the common dictionary as *procurement*. For the purpose of this thesis, it is important to make a distinction between the definitions of the terms *procurement* and *acquisition*. *Procurement* includes "purchasing, renting,

leasing or otherwise obtaining supplies or services. (And) all the functions that pertain to obtaining them." [Ref. 10:p. 315]

Acquisition is a more encompassing and precise Government term that means, "the acquiring by contract with appropriated funds of supplies or services by and for use of the Federal Government through purchase or lease." [Ref. 10:p. 311] These functions are performed employing some form of a legal instrument, like a purchase order, a credit card invoice or a contract. A contract is "an agreement which creates an obligation" that includes the following essential elements: 1) competent parties, 2) subject matter, 3) legal consideration, 4) mutuality of agreement, and 5) mutuality of obligation. [Ref. 10:p. 11] The common objectives of both of these processes are to obtain a required product or a service, on time and at a reasonable price. The shared elements of a typical procurement and acquisition are [Ref. 10:p. 311]:

- Needs that are established to include the description of requirements to satisfy these needs
- Solicitation and selection of sources
- Award of the contract
- Contract administration
- Technical and management functions directly related to the process of fulfilling agency needs by contract

The Federal Acquisition Process (FAP) is the standard process model used throughout the Defense Acquisition University. The FAP is a comprehensive representation of the all the functions of Government acquisition, and it establishes the

fundamental basis of the acquisition process. [Ref. 11:pp. 5-9 to 5-11] The FAP is a comprehensive representation of the complex acquisition system, broken down into 85 functions. The FAP covers the essential elements analyzed for potential innovation in this thesis. McCarthy presented an innovation to the FAP, one in which incorporates SPS with these functions. [Ref. 6:p. 107] The researcher takes this model and develops the framework for innovation to enhance the SPS with IA. Before we continue, we need to also examine the Federal acquisition environment.

2. Federal Acquisition Environment

Despite these commonalties, the FAP is much more complex and varied than the basic procurement process. This is because of the numerous Federal regulations, such as the Federal Acquisition Regulation (FAR) and the Defense Federal Acquisition Regulation Supplement (DFARS) instituted to ensure the proper stewardship of public resources. But these requirements, intended to preserve and to protect the process from fraud, waste and abuse, have become so elaborate and encompassing that they may actually hinder efficient and effective contracting. [Ref. 6:pp. 17-24] As a result, more aggressive acquisition reform measures began in the Eighties to restore a better balance of these requisite boundaries and to foster a more productive business climate. In addition to these burdensome regulations, procurement offices throughout DoD are laden with Government, service, and office unique procedures. [Ref. 12:p. 118]

> These differing agencies' procurement processes dictate a variety of purchasing methods is developed as well. Thus, purchasing methods are not uniform throughout the Government. Moreover, within an individual Agency, the processes can vary from case to case according to the Agency mission, dollar value, type of contract, and end product involved.

One reason for acquisition reform is to standardize a diversity of idiosyncratic processes and remove unneeded regulations in order to devise a more business-prudent system. Many of these initiatives are transforming Government acquisition into a more commercial-like practice that is better balanced with only essential rules to maintain minimal accountability. This is not an easy task because the Government does not operate like a normal business (e.g. it is not organized for profit, it has strict limitations on the use of funds, it is politically driven, and it produces goods and services for common use).

Another impetus for reform is political. Politicians are key stakeholders throughout the acquisition process, and competing priorities often determine what reform measures are implemented. [Ref. 13:p. 1] Since the Government is not a normal business, Federal procurement must conform to a higher standard to maintain proper accountability. Therefore, there has been frequent and lengthy legislation to decide exactly what rules should be changed. It is now important to look at the major reform initiatives and to see how they relate to the acquisition environment.

a. Acquisition Reform Initiatives

Recent acquisition reform initiatives have essentially reduced the amount of justifying documentation for acquisitions--the lower the dollar value of the transaction,

the less regulation. The Government can more efficiently and effectively manage these acquisition actions if the law allows them to operate more like a business, using commercial "best practices." [Ref. 14:p. 1] These laws have significantly shaped the acquisition environment, allowing acquisition and contract managers to bypass restrictive, inadequate laws and exercise new practices.

1. The Competition in Contracting Act. The Competition in Contracting Act of 1984 (CICA) affects practically all areas of acquisition by shifting the emphasis from the *method of procurement* to the *use of resources*. CICA emphasizes the use of competitive procurement procedures rather than contracting from a single source. It also acts to eliminate procurement procedures and practices that inhibit free and open competition. [Ref. 10:p. 21] Perhaps its most significant impact was the congressional urging that Federal agencies better plan and prepare competitive procurements. [Ref. 15:p. 81] It requires the use of a "standard procurement planning" process, yet neither CICA nor subsequent legislation define what constitutes this "standard." [Ref. 15:p. 26]

2. The Federal Acquisition Streamlining Act. In order to make changes for the better utilization of limited resources, the Clinton administration directed the definition of an architecture for a Government-wide electronic commerce (EC) capability in October 1993. This event was the culmination of an Executive Memorandum signed by the President that same month, which directed the executive agencies to fundamentally alter and improve the method by which they acquire goods and

services. Under the President's Management Council, the Administrator of the Office of Federal Procurement Policy (OFPP) chartered the Federal Electronic Commerce Acquisition Team to develop the Federal EC architecture for the 22 million annual U.S. Government purchase transactions. [Ref. 16:pp. vi-vii] This action set forth several legislative events, including the Federal Acquisition Streamlining Act of 1994 (FASA).

FASA repeals 225 provisions of laws affecting the acquisition of commercial items, the Truth in Negotiations act, contract formation, bid protest and debriefing, contract administration and small business affairs. FASA created the micro-purchase threshold of $2,500, the simplified acquisition threshold (SAT) of $100,000 and its accompanying simplified acquisition procedures (SAP), and, more importantly in this context, the freedom to use EC. [Ref. 10:p. 22] FASA also mandated the establishment of a Federal Acquisition Computer Network (FACNET) architecture. FACNET enables Federal agencies and vendors to do business electronically in a standardized fashion for purchases valued above the micro-purchase threshold up to the SAT. Of the $200 billion that the Government workforce expends per year on goods and services, 98% of all the transactions fall into this category. [Ref. 11:p. 1] Subsequent legislation was required to ensure that these standard practices were refined and used with common sense.

3. The Federal Acquisition Reform Act. Following the passage of FASA, the Federal Acquisition Reform Act of 1996 (FARA) allowed the Government to take more proactive steps toward becoming a world-class buyer. DoD began working

with the OFPP to fully implement these groundbreaking statutes because rapidly changing technology in electronic purchasing methods, and specifically the growth of Internet commerce, were revolutionizing the global market place. In response, the Authorization Act of FY 1998 enacted provisions that eliminated total reliance upon FACNET and allowed alternative means of implementing EC. [Ref. 17:p. 1]

4. Federal Acquisition Regulation Part 15 Rewrite. One of the most significant results following FARA was the inclusion of various EC dimensions in the September 1997 rewrite of Federal Acquisition Regulation (FAR) Part 15. [Ref. 18] This rewrite was a further attempt to align applicable aspects of DoD acquisition with the best practices of commercial business, allowing for more proficient acquisition by decreasing those regulations that impose unnecessary burdens on business and industry contracting officers. The rewrite introduces new procedures to simplify and reduce the source selection and contract award processes by focusing on "best value" instead of "lowest price" contacting. It also allows the use electronic means to transfer acquisition documents, like request for quotes and fund transfers. [Ref. 14]

b. Reform Manifestations

The goal of acquisition reform is to amend existing regulations with better business practices that ensure that the Government acquires goods and services at the best value possible with the minimal amount of oversight. [Ref. 13:p. 189] It is imperative to examine how these reforms are manifested in various areas of the acquisition environment.

1. Electronic Procurement. The global use of EC continues to grow at a phenomenal rate and is gaining popularity in Government contracting. The application of a home personal computer (PC) modestly equipped with a modem, phone line, Internet service provider, Web browser and other basic software programs, is remarkable when compared to the office-place capabilities of the last generation. It is possible to transfer funds for purchases or banking, monitor elaborate financial portfolios, search for and make reservations for the best event tickets after being informed via E-mail, participate in live on-line auctions, browse vast numbers of merchandise catalogs, and research the world for products and specific companies on the Internet. With the increased power of larger computers, firms can leverage these technologies into their acquisition programs.

Federal Acquisition Regulation Part 4.05, "Electronic Commerce in Contracting," states that the Government shall exercise broad discretion to use EC whenever practical and cost-effective. The future growth of EC is very promising towards assisting in the Government's trend of increasing efficiency, but the FAR stipulates that EC must be able to: [Ref. 19]

- implement uniformly throughout the Agency, to the maximum extent possible
- facilitate access to small, disadvantaged and women-owned businesses
- comply with national and international industry standards
- ensure adequate security

2. Single Face. Another aspect of reform is DoD's goal to provide a "single-face" to industry, one common and accessible entry for commercial industry to do business with the Government. [Ref. 20] It began with the creation of FACNET, which would allow all Government agencies to conduct many acquisition transactions using electronic data interchange (EDI). EDI uses a common standard (ANSI X12), implementation convention, telecommunications infrastructure, and set of business practices to transmit precise electronic documents, like a purchase request, over a sophisticated electronic network with major commercial trading partners. The benefit of the single-face concept is that once vendors are EDI-capable, they can register at a single point, a Central Contractor Registration (CCR) with the Government, and conduct business with all DoD and civil agencies. As of October 1998, there were 125,516 active CCR registrants. [Ref. 21]

However, this implied that all non-EDI compliant Government procurement systems, like the independent electronic bulletin board posting systems (BBS) operated by many activities, had to be either modified to comply with the single-face concept or be terminated. [Ref. 20] As discussed under FARA, the requirement to make FACNET optional allowed for the continued use of unique systems like the BBS. The Government realized that other EC methods were practical and necessary to create the single-face. DoD is currently modifying or replacing most of the older automated "legacy" systems with SPS so that it complies with the single-face concept. However, a comprehensive single-face concept remains a goal but not a reality. It will take years

before the single-face concept is accomplished, if that in fact makes sense to do so in every aspect.

3. Paperless Contracting Initiative. Another aspect of reform is to drastically reduce the amount of paper received, processed, and stored in the Government procurement shops, contract administration area offices and the Defense Finance and Accounting Service (DFAS) contract pay operations. [Ref. 1:p. 1] Though substantial progress has been made, there are voids and paper hand-offs in the current process as paper copies of some documents may always be required. The following are some of the many EC initiatives in place in various stages of operation to achieve the January 1, 2000 paperless goal. [Ref. 22]

- Electronic mail and facsimile
- Electronic and World Wide Web (WWW) interactive forms
- Federal EC Model business opportunities, the posting of numerous new business opportunities onto a single Web site
- Sharing documents using Electronic Data Access (EDA), Electronic Document Management (EDM), and Electronic Document Workflow (EDW)
- Wide Area Workflow (WAW), an integrated Web version of EDA, EDM, EDI and EDW
- On-line purchasing using DoD Electronic Mall (EMALL), GSA Advantage, etc.
- Web invoicing
- Electronic Funds Transfer (EFT)
- International Merchant Purchase Authorization Card (IMPAC) and other micro-purchase credit cards

- Contract Closeout Checklist, available on-line and automatically E-mailed when required
- Smart Cards
- Centralized Contractor Registration (CCR)
- Past Performance Automated Information System
- Technical Data Package Material Information System (TDPMIS)
- DoD EC Navigator, a Web-based guide for EC resources
- Public Key Infrastructure (PKI), a security encryption system

4. Standardized Procurement. Even with a single-face to industry and a common infrastructure, DoD agencies still utilize many different acquisition forms and procedures for common transactions. In order for all of these systems to integrate, a standard acquisition process was needed. As agencies began to pursue FACNET partnerships, it became apparent that FACNET was too rigid and limiting, as all trading partners had to be EDI capable to participate. To create a more open and friendly system, the Government sought to implement a standard process that could be more easily utilized. In April 1997, the Government contracted for the development of SPS as the cornerstone catalyst to integrate a common acquisition process across all of DoD to standardize all activities. This $241 million, ten-year contract with American Management Systems, Inc. (AMS) would provide 44,000 user-licenses and specified training and support at 1,100 sites. [Ref. 5]

5. Government EC. Computer technology advances have increased the ability to access and process information on the World Wide Web (WWW) via the Internet. The Government uses large computer systems to store acquisition data, which can be readily accessed and transmitted to facilitate communication and procurement transactions. For example, the Government employs numerous management information systems (MIS).

The Commerce Business Daily (CBD) is an elementary MIS that lists notices of proposed Government procurement actions, contract awards, sales of Government property and other procurement information. A new CBD edition is published each workday and contains from 500 to 1,000 notices covering most of the Government's procurement actions over $100,000. The CBD network option (CBDNet) is a free electronic version that provides increased range and ease. However, notices in CBDNet are not official until printed in the hardcopy CBD. [Ref. 23] Under FASA and FARA, Government agencies are no longer required to post solicitations for purchases under $100,000 in the CBD if they are being transmitted via a FACNET architecture or other approved EDI-based system, like SPS. However, agencies must still post solicitations for purchases for over $100,000 and for purchases not being transmitted via FACNET in the CBD. [Ref. 20]

Government MIS also post vital acquisition data on Web pages, benchmarking commercial industry practices. The Electronic Posting System (EPS),

initiated by the National Aeronautics and Space Administration (NASA), whose programs are exempt from many Federal restrictions, is a one-stop, interactive web-based BBS that posts new business opportunities and other acquisition data for all twelve NASA activities and their customers. EPS uses a sophisticated E-mail system that automatically informs customers when requested transactions are initiated, like proposal or award submission. [Ref. 24]

Another Internet-based system is the Army's Communications and Electronics Command (CECOM) business opportunities page (BOP). Similar to NASA, CECOM does not use EDI or a unique acquisition software suite. CECOM uses the BOP to conduct a majority of its contracting functions by the E-mailing of common documents, like word processing and spreadsheets, and accessing shared databases over the Internet. [Ref. 25].

On-line purchasing is already widespread among Government agencies, allowing authorized partners to conduct complete transactions for many standard items. The DoD Electronic Mall (EMALL) offers products and services including clothing, subsistence, medical supplies, combat vehicles and construction. [Ref. 26] Incorporating on-line shopping and other EC practices into Federal acquisition raise relevant questions that must be addressed. It is imperative to understand these EC issues before moving on to innovate SPS.

3. Issues with Electronic Commerce

a. Legality

The first issue with EC is a legal one and relates to the authenticity of electronic transmissions without traditional signatures or hard copy original records. A document is considered to be authentic and unique even when it is in an electronic form because it has a unique digital fingerprint. [Ref. 27:p. v] FAR 1.102-4 (e) states "if a policy or procedure, or a particular strategy or practice, is in the best interest of the Government and is not specifically addressed in the FAR, nor prohibited by law . . . (do not) assume that it is prohibited." Therefore, creative EC is encouraged and authorized as long as it makes common business sense. One could argue that EC, and the further use of IA, is unfair to small and disadvantaged businesses. This would be difficult to support due to the ease and relative small cost of participating in EC [Ref. 28:p. v], which SPS-like systems support, and such strong political backing. [Ref. 27:p. v]

b. Security

Questions about EC security are justified due to frequent privacy and access violations. Because there is so much data on the Internet, some of a restricted and confidential nature, proper safeguards must be executed. Graduate research has concluded that the current encryption and decryption technology provides the requisite security for the Government to conduct contracting on the Internet, but it is also evident that continual efforts to safeguard EC are required. [Ref. 27: p. v]

c. Interoperability

There are numerous DoD acquisition systems operating in various stages, ranging from the small manual systems to 100% SPS operational sites. The big challenge is to integrate these different systems so that they can work together. [Ref. 6: p. 1] To help facilitate this task, the Government instituted several offices and numerous committees to assist in implementing standard systems, conduct training, provide information and promote opportunities. These include the Federal Electronic Commerce Program Office, the Joint Electronic Commerce Program Office (JECPO), National Electronic Commerce Policy (NECP), the National Electronic Procurement Assistance Center (NEPAC), the Defense Systems Management College, the Interagency Electronic Grants Committee, and the Federal EDI Standards Management Coordinating Committee (FESMCC). [Ref. 29:p. 1]

Since the award of the SPS contract, progress has been made to replace or integrate SPS with the eleven major legacy systems in use by DoD acquisition offices, listed in Table 1. In February 1998, the first command fully implemented SPS version 3.5. [Ref. 2:p. 7] In April 1999, SPS replaced the Navy's APADE system, one of the largest remaining legacy systems. [Ref. 31:p. 10] SPS version 5.1 is scheduled to phase-out seven legacy systems and integrates with MOCAS by 2003. [Ref. 30]

d. EC Costs

Electronic commerce costs come in many forms and ranges from the nominal to the enormous. For example, it costs less than $2,000 for an initial outfitting

Table 1. Legacy Systems [Ref. 30]

AMIS	Acquisition Management Information System
APADE	Automation of Procurement and Accounting Data Entry
BCAS	Base Contracting Automated System
BOSS	Base Operating Supply System
CCR	Central Contractor Registration office
DCD/DCW	Defense Finance and Accounting System (DFAS) Corporate Database/DFAS Corporate Warehouse
DPACS	Defense Logistics Agency (DLA) Pre- Award Contracting System
ITIMP	Integrated Technical Item Management Procurement System
MOCAS	Mechanization of Contract Administration Services
PADDS	Procurement Automated Data and Document System
SACONS	Standard Automated Contracting System

a PC and less than $25 a month for an Internet service provider. The cost to set up an EDI-capable small business is less than an initial investment of $5,000 and $300 to $1,000 a month, depending on the volume of transactions. [Ref. 20:p. 12-1] In early 1998, the House spent $1 million to obtain 100 licenses, training and support for Procurement Desktop (PD), which provides electronic forms for creating acquisition documents and a FAR database. [Ref. 32:p. 14] The Government has obligated over $100 million over the original $241 million allotted for the implementation of SPS. [Ref. 4] There are also maintenance, technical support, and other operating costs not covered in the existing

contract that need to be considered. A May 1999 DoD Inspector General (DoD-IG) report stated that the current SPS contract calls for at least an additional $70 million just to meet such unanticipated requirements. [Ref. 4]

e. Training

Sophisticated automated information systems like SPS are not easy to use and require substantial training. Management would hope that a new system like this would reduce training, but, in the short term, these training requirements tend to increase as technology increases due to the large learning curve. Training the Government acquisition corps is challenging in that there is a high rate of military personnel turnover, increased responsibility attributed to Defense downsizing, and the "graying" of the aging workforce. Many of these experienced acquisition professionals have limited IT know-how, and training costs are very high because of the required travel and instructor premiums. AMS utilizes interactive CD training modules and Frequently Asked Questions (FAQ) Web pages in an attempt to reduce this cost to the user. [Ref. 5]

f. Reluctance

Many people, including those "graying" personnel, were not raised in the current computer-literate generation, avoid technology or just have a hard time understanding new applications. The introduction of more advanced technology like IA will create more initial reluctance and concern that personnel requirements may be reduced. [Ref. 5] Therefore, people might be reluctant to welcome a new IT because they fear that they may lose their jobs and be replaced by a machine in the long run.

g. Summary

The rudimentary procurement process consists of common elements that are practiced in the FAP. Reform has opened the door for the use of enabling EC to streamline Government acquisition. But the use of EC has serious issues that must be understood before innovating the process. IA capability is a niche technology that offers great rewards for its investment, but the question remains how can we best reengineer the FAP to reap the benefits.

B. FEDERAL ACQUISITION PROCESS (FAP)

1. Overview

With this background information regarding the environment and issues surrounding the Federal procurement process, we now examine the basics of the FAP. We use the term "standard acquisition process" to describe the foundational, current acquisition process as practiced in the DoD per FAR Part 7. The FAR does not define the entire process, but it does detail what documentation is required. [Ref. 33:p. 26]

For the purpose of this thesis, the researcher utilizes the 85 functions of the Federal Acquisition Process. [Ref. 11] Table 2 lists the principle activities segregated into the three phases of the FAP: 1) Acquisition Planning, 2) Contract Formation, 3) and Contract Administration. These three phases cover the entire acquisition lifecycle from initial need to contract closeout. Each phase is briefly discussed in turn and only illustrates the typical acquisition process by the Government. This simplified process is foundational to understanding how SPS operates and how the

Table 2. The Federal Acquisition Process [Ref. 11]

Phase I. Acquisition Planning	
A. Determination of Need	11. Set-Asides
1. Forecasting Requirements	12. 8(a) Procurements
2. Acquisition Planning	**D. Source Selection Planning**
3. Purchase Requests	13. Lease vs. Purchase
4. Funding	14. Price Related Factors
5. Market Research	15. Non-Price Factors
B. Analysis of Requirement	16. Method of Procurement or Purchasing
6. Requirements Documents	**E. Solicitation Terms & Conditions**
7. Use of Government Property/Supply Sources	17. Contract Types— Pricing Arrangements
8. Services	18. Recurring Requirements
C. Extent of Competition	19. Unpriced Contracts
9. Required Sources	20. Contract Financing
10. Competition Requirements Unsolicited Proposals	21. Need for Bonds
	22. Method of Payment
	23. Procurement Planning
Phase II. Contract Formation	
F. Solicitation of Offers	38. Pricing Information From Offerors
24. Publicizing Proposed Contract Actions	39. Audits
25. Oral Solicitation	40. Cost Analysis
26. Solicitation Preparation	41. Evaluating Other Offered Terms and Conditions
27. Preward Inquiries	42. Award Without Discussions
28. Prebid/Prequote/Preproposal Conferences	43. Communications/Fact-finding
29. Amending/ Canceling Solicitations	44. Extent of Discussions (Competitive Range)
G. Bid Evaluation	45. Negotiation Strategy
30. Processing Bids	46. Conducting Discussions/Negotiations
31. Bid Acceptance Periods	**I. Contract Award**
32. Late Offers	47. Debriefing
33. Price Analysis —Sealed Bidding	48. Responsibility
34. Responsiveness	49. Subcontracting Requirements
H. Proposal Evaluation	50. Prepare Awards
35. Processing Proposals	51. Issue Awards & Notices
36. Applying Non-Price Factors	52. Mistakes In Offers
37. Price Analysis— Negotiations	53. Protests

Table 2 (continued)

Phase III. Contract Administration	
J. Initiation of Work and Modification	70. Administering Financing Terms
54. Contract Administration Planning	71. Unallowable Costs
55. Post-Award Orientations	72. Payment of Indirect Costs
56. Consent to Sub-contracts	73. Limitation of Costs
57. Subcontracting Requirements	74. Price and Fee Adjustments
58. Contract Modifications	75. Collecting Contractor Debts
59. Options	76. Accounting & Estimating Systems
60. Task & Delivery Order Contracting	77. Cost Accounting Standards
K. Quality Assurance	78. Defective Pricing
61. Monitoring, Inspection, and Acceptance	**M. Special Terms**
62. Delays	79. Property Administration
63. Stop Work	80. Intellectual Property
64. Commercial/Simplified Acquisition Remedies	81. Administering Socio-Economic/ Other Misc. Terms
65. Noncommercial Remedies	**N. Contract Closeout or Termination**
66. Documenting Past Performance	82. Claims
L. Payment & Accounting	83. Termination
67. Invoices	84. Closeout
68. Assignment of Claims	85. Fraud & Exclusion
69. Administering Securities	

direction of further innovation must progress. Subsequent chapters draw from Table 2 to detail the process.

2. FAP Activities

a. Determination of need

Phase I of the FAP is acquisition planning. The first stage of the acquisition-planning phase is to approve or to authorize the initiation of a Government requirement. A requirement is defined as a determination within an Agency that needs to

be satisfied. The requirement must be reviewed in the context of the organization's mission, resources and priorities. Once the user's requirement has been approved, it is validated, authorized and funded. A purchase request (PR) is produced to identify and initiate the requirement, containing the following elements: 1) a description, 2) date required, 3) recommended sources, 4) shipping and packaging information, 5) funding information. [Ref. 12:pp. 2-15] The PR is forwarded to the appropriate procurement office for further action. Once the PR is approved and submitted, the contracting officer (CO) determines how to best conduct the acquisition.

b. Analysis of requirement

The CO determines, based on his or her experience and the nature and characteristics of the PR, how to best acquire the product. For example, the CO desires if it will be competitive or noncompetitive, a purchase or delivery order, or a standard contract. Before this can be effectively accomplished, the extent of competition must be determined.

c. Extent of competition

When the type and method of acquisition is determined, the CO must take into consideration the extent of competition in the marketplace and the CICA requirements for "full and open competition." For the context of this thesis, procurements are made by competitive proposal methods for items above the micro-purchase level and that fall below the SAT, which include commercial items below $5 million, allowing for the use of Simplified Acquisition Procedures (SAP).

d. Source selection planning

Once the CO has determined what is the best method to conduct the acquisition, the best source must be selected. The CO must initiate a source selection plan prior to advertising that clearly defines the method of procurement and selection evaluation factors. This ensures that the procurement is being executed fairly and honestly, and that all proposals are equally evaluated. It is also during this planning phase at which the CO determines if the product is acquired using a fixed-price or cost-reimbursement contract. [Ref. 6:p. 30]

e. Solicitation terms and conditions

Another major issue in regards to procurement planning is addressing the terms and conditions of the solicitation. A solicitation document is drafted to inform potential offerors of all unique conceptual arrangements that pertain to the PR. The solicitation terms and conditions address issues that may have a significant impact of the performance of the contract, like contract financing and the use of Government furnished property. [Ref. 12:p. 1]

f. Solicitation of offers

Now that the acquisition is fully planned, the PR is announced to all potential sellers. This marks the end of the acquisition planning and the beginning of the contract formation phases. The method of this solicitation is dependent primary on the dollar value of the contract. Procurements over the SAT are formally advertised in the CBD. [Ref. 12:p. 2] These solicitations must be submitted at least 15 days prior to the

date of issue and less than 30 days before closing. For requirements under the SAT, the mandatory use of the CBD is waived and alternate forms of electronic posting are authorized. Only a minimum of 15 days is required for solicitation.

g. Bid evaluation

Solicitations are conducted in two fashions: sealed bids and proposals. In the first case, after the offer solicitation time period has elapsed, bids are received and evaluated. Each bid is appraised individually to determine if it is both "responsible and responsive." If these conditions are met, then each bid is individually evaluated by a separate group of individuals, generally via price analysis. [Ref. 19] This function is outside the scope of this thesis and is not analyzed.

h. Proposal evaluation

In the second case for proposals, the evaluation occurs in a more detailed format. Each proposal is appraised individually against the same scheme depicted in the source selection plan. After each proposal is evaluated, a separate group of people ranks the proposals against each other. It is then the CO's, or a designated representative's, responsibility to make a final decision and award the contract. Before this can occur, those proposals that are within the competitive range may require additional analysis, especially if they are closely rated to each other. This may entail several forms of pre-award communications with potential awardees, like discussions, cost or price analysis, audits and fact-finding visits. Evaluation factors generally include cost or price, price related factors, technical approach, management capability, past performance and quality.

Under SAP, the CO can perform these actions in an abbreviated format as long as they are adequately justified and documented. [Ref. 19]

i. Contract award

After the completion of all pre-award activities, the CO awards the contract to the offer that represents the best value. The Government requires that all unsuccessful offerors receive a debrief to promote fairness and quality of future transactions. This ends the award phase and marks the conclusion of the Procurement Administrative Lead-Time (PALT), a significant metric indicating how long it takes for a requirement to be satisfied through contract award. This also concludes phase II of the FAP, contract formation.

j. Contract administration

As soon as the contract is awarded and goods or services are rendered, then the third phase, contract administrative, commences. During this phase, the contract is monitored for quality, performance, proper payment and accounting practices. Contract administrative actions include activities like changes, modifications, terminations, equitable adjustments and options.

k. Contract closeout

The acquisition process is concluded when the contract is closed out after all goods and services are completed and satisfy the contract, and that all claims and final payment are processed in a timely fashion per the terms and specifications. Contract

administration functions include demilitarization, disposal of hazardous material and return of Government furnished equipment.

Building on this theme, we now look at a brief examination of the benefits and disadvantages of standard Government acquisition. McCarthy utilized this background into her analysis and innovation of SPS, which is pertinent to further discussion of this thesis. The following sections are a synthesis of McCarthy's findings and the researcher's common understanding of the process.

3. Standard Acquisition Benefits

The first major benefit of the Government's standard acquisition process is its automated infrastructure and systems, which are abundant in DoD. These systems work effectively to manage billions of dollars each year throughout the entire acquisition process. The second benefit is its flexibility. Each Agency also has a unique capability to tailor its procurement process to meet the current needs of existing systems. These systems work well and are maintained as long as the regulatory requirements and mission objectives are satisfied. These autonomous units can be manipulated to share information with other units as required. Finally, DoD has a solid core of skilled acquisition personnel who understand this unique system. They have substantial experience working on the same systems for many years and are not easily replaced. [Ref. 6:p. 34]

4. Standard Acquisition Disadvantages

The primary disadvantage of the standard acquisition process is that it is neither "standard" in its process or its system. Agencies do not use the same forms, procedures or regulations in their processes. Of the existing systems, there are hundreds of different

databases that are not shared. In addition, these systems are not easily integrated to communicate with each other, nor do they perform the activities of the standard acquisition process in exactly the same manner. Not only this, but a few of the activities and many processes are not automated. A classic example is that most offices conduct market research and prepare documentation without using data from other offices. Therefore, repetitive and duplicate actions are performed, and even recreated, at each activity. Finally, the standard system does not have an integrated payment system. Excessive administrative deficiencies such as incorrect and late billings are detrimental to the competence of Government acquisition. These problems have been so bad in the past that some commercial industries now refuse to conduct business with the Government. [Ref. 6:p. 35]

5. FAP Summary

This standard process model is only a simplified representation of a complex acquisition system, yet it covers the essential elements analyzed for potential innovation in this thesis. The pros of standard procurement fortunately outweigh the cons. The researcher takes this model and develops the framework for innovation to enhance the SPS with IA. Before continuing, we need to also examine the functionality of SPS.

C. STANDARD PROCUREMENT SYSTEM

1. Overview

SPS is a comprehensive movement toward standardization and paper-free contracting that is scheduled to support nearly 44,000 users at 1,100 sites worldwide. SPS

originated as a commercial-off-the-shelf (COTS) workflow system. The DoD's acquisition version of SPS is called Procurement Desktop-Defense (PD^2). PD^2 replaces 76 existing automated interfaces to financial, logistics, and other systems, as well as the remaining manual systems, with a single, automated, paperless contracting-support application. [Ref. 30]

PD^2 uses a layered technical approach that creates an open and flexible system to support current DoD infrastructure environments. This allows offices to support multiple operating systems, databases and networks at the bottom layer. The desktop allows users to have a standard graphical user interface and to perform numerous common functions outside of PD^2. [Ref. 8]

2. SPS Functions

AMS categorizes the functionality of PD^2 into the nine activity phases that are divided into three menus: 1) requirements, 2) Pre-award/Award, 3) Post Award. Table 3 provides a comparison of the FAP phases and PD^2 functionality. [Ref. 8, Ref. 11] These functions, which cover the majority of the acquisition process, are detailed and analyzed in subsequent chapters. As seen above, SPS addresses most phases and activities in the acquisition lifecycle. PD^2 is designed to mirror the objects and workflow throughout the Government acquisition process, adding more functionality with each new version. [Ref. 8] It functions to prepare and administer contracts using electronic data transfer, filing, forms and reference libraries. [Ref. 30]

Table 3. Comparison of FAP and PD²

Federal Acquisition Process	PD² Functionality
Phase I. Acquisition Planning	**Menu I. Requirements**
Determination of Need	Requirement Definition
Analysis of Requirement	Pre-solicitation
Extent of Competition	
Source Selection Planning	
Solicitation Terms and Conditions	
Phase II. Contract Formation	**Menu II. Pre-Award/Award**
Solicitation of Offers	Solicitations/Amendments
Bid Evaluation	Evaluation/Source Selection
Proposal Evaluation	Award
Contract Award	
Phase III. Contract Administration	**Menu III. Post-Award**
Initiation of Work and Modification	Award Administration
Quality Assurance	Receipt/Acceptance
Payment and Accounting	Payment
Special Terms	Closeout
Contract Closeout and Termination	

Source: Developed by the researcher.

Using a simplified example, a manager can task a user, based on their experience and current workload, to create a new purchase request (PR) with specified requirement information. The user can retrieve an old, approved PR from an electronic archive file and add the unique data from his or her desktop computer. The PR can then be automatically routed through the appropriate channels for approval and then submitted to the CBD for announcement. SPS can also send out requests for quotes and receive offers, all via EDI. SPS can select the contract type, rank the offers by price and automatically

formulate all the sections of the contract, like clauses, the statement of work, terms and conditions and payment procedures. The manager can track all these actions on-line, receiving notice when actions are and are not completed in accordance with established milestones.

Once the current release, the version 4 series, is accepted and successfully implemented, the version 5 series will be initiated, and subsequent versions are planned for release periodically. For example, new SPS capabilities are just beginning to work with external systems using the Internet, as AMS introduced a new Internet-based product called AcquiLine that uses an Internet interface to include organizations that are left out of SPS because they are not EDI-capable. PD^2 is not designed to process micro-purchases and major weapon systems. [Ref. 31] Rather, its focus is on mid-range procurements, such as those within the simplified acquisition threshold.

It is imperative to examine the pros and cons of SPS as understanding this background is essential before progressing to further analysis. The following sections give a brief discussion of several advantages and disadvantages of SPS that McCarthy listed in her thesis.

3. SPS Advantages

The main advantage of SPS is the potential long-term cost savings incurred by sharing useful acquisition information throughout all of DoD on a standard computer-based system and streamlining associated with a semi-automatic paperless procurement process. [Ref. 6:p. 34] DoD is expected to have operational benefits of $1.8 billion, a high rate of return on a projected investment of $433.5 million investment. [Ref. 4]

These savings should reflect time reductions and improved efficiency, allowing personnel to focus their energies on performing more value-added, analytical and upper-level management skills.

4. SPS Disadvantages

The SPS contract was awarded to increase efficiency by automating and standardizing key elements of the procurement process. Even though this is a great step in the right direction, it has not been without its problems. SPS' primary disadvantage is that it is a complex and difficult answer to a likewise detailed and complicated acquisition problem. [Ref. 6:p. 35] It is a common management fallacy to throw automation at a problem to fix it. As M. Hammer stated in his article "Reengineering Work: Don't Automate, Obliterate:"

> ...heavy investments in information technology have delivered disappointing results - - largely because companies tend to use technology to mechanize old way of doing business. They leave existing processes intact and use computers to simply speed them up...it is time to stop paving the cowpaths. Instead of embedding outdated processes in hardware and software we should obliterate them and start over. [Ref. 33]

The combination of "paving cowpaths" and the hundreds of software problems experienced to date, some of which one would expect with any new IT system, have delayed the implementation of SPS by over a year, jeopardizing DoD's goal to be paper-free by 1 January 2000. Even though the DoD-IG reports phenomenal operational benefits, the enormous start-up costs to install and maintain are more remarkable. The same report stated that the life-cycle costs for fiscal year 1995 through 2005 are estimated

at $2.9 billion [Ref. 4]; SPS has yet to produce any marginal short-term benefit. [Ref. 6:p. v] Despite the delays and sunk costs, so far, DoD is committed to the implementation of SPS. [Ref. 4:p. 1]

5. SPS Summary

SPS is slowly and methodically overcoming the software and hardware challenges reluctance and criticism, multiple priorities, tasking and training issues. Although SPS has good acquisition applications, the major criticisms are its huge cost and inflexible design that attempt to meet the Government's unrealistic goal to standardize and automate a system, which is neither standard nor ready for automation. The mature version of PD^2 promises to be comprehensive, functional and economical. The Government needs to improve its acquisition system, but to just automate an existing inefficient structure does not fully address the source of the problem. We now discuss the innovation of Government acquisition beginning with a high-level discussion on process reengineering.

D. PROCESS REENGINEERING

1. Overview

Reengineering has been a popular mantra in the area of acquisition reform. Top Defense officials made it clear that the Government needs to make major improvements. The Quadrennial Defense Review (QDR) of 1997 reviewed the Defense posture, policies and programs which identified threats, areas of risk and opportunities through the year

2015. This comprehensive review was the foundation for the Defense Reform Initiative (DRI) which stated that the DoD needs to practice:

> ...the key business principles that American industry has successfully used to become leaner and more flexible in order to remain competitive. The resulting savings will help fund the 'Revolution in Military Affairs', to ensure American military superiority in the future. Equally important, the DRI is aimed at ensuring that DoD support elements are agile and responsive to support the warfighters, who are rapidly applying new technologies to change the way they fight [Ref. 35]

Drawing from prior research, Federal acquisition requires reengineering and SPS is a classic example of throwing IT at an inefficient system. Acquisition needs to be redesigned before it is automated; obviously we have already tried to improve it with SPS. [Ref. 6:p. v]

It is important to discuss the fundamental nature of reengineering before continuing onto the methodology of innovating SPS. The following sections discuss the difference between improvement and reengineering, Davenport's innovation process, knowledge-based system redesign and the findings of McCarthy's thesis on innovating the standard procurement process, all which are foundational to the purpose of this study.

2. Improvement versus Reengineering

The terms *improvement*, *innovation*, and *reengineering* have similar meanings which need clarification. First of all, Webster's Dictionary defines the *process* as "a natural phenomenon marked by gradual changes that leads toward a particular result or a natural continuing activity or function." [Ref. 36:p. 821] It defines *improvement* as "the act or process of improving, the state of being improved, enhancing value or excellence."

[Ref. 36:p. 707] The combination of these two concepts gives us the foundation for the concept of *process improvement.* Davenport states that "process improvement involves performing the same business process with slightly increased efficiency or effectiveness." It is a change made gradually or in steps, which takes an attentive look from the bottom at the lowest action of an existing process and focuses on improving a specific process. [Ref. 9]

Innovation is a step beyond improvement, as Davenport differentiates the two processes in Table 4. *Innovation* is "the introduction of something new, a new idea, method, or device." [Ref. 36:p. 726] Process innovation involves introducing a new studied process into the larger business process. It is an analysis of not only the entire process, but of how that process meets the overall objective of the business. It is intended to increase efficiency of the entire business formula. This approach does not have a defined conclusion, but looks at identifying and eliminating redundant or worthless processes under the assumption of continued improvement. By making a studied, yet radical change, process innovation has the potential to significantly reduces cost and a improve efficiency. Davenport defines *process innovation* as

> ...stepping back from a process to inquire into its overall business objective, and then effecting creative and radical change to realize order-of-magnitude improvements in the way that objective is actually accomplished. [Ref. 9]

Process innovation and reengineering are also referred to as Business Process Redesign (BPR), but *reengineering*, in the context of this thesis, takes on more specific

Table 4. Process Improvement versus Process Innovation [Ref. 9]

Function	Improvement	Innovation
Level of Change	Incremental	Radical
Starting Point	Existing Process	Clean Slate
Frequency of Change	One Time/Continuous	One Time
Time Required	Short	Top Down
Participation	Bottom Up	Top Down
Typical Scope	Narrow within Functions	Broad Cross Functional
Risk	Moderate	High
Primary Enabler	Statistical Control	Information Technology
Type of Change	Cultural	Cultural/ Structural

meaning. *Reengineering* is "... the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures such as cost, quality, service and speed." [Ref. 37:p. 32] Reengineering is *fundamental* in the sense that nothing is considered as fixed or unchangeable, giving the notion that there are no real barriers to effect change on each level of an organization. It is *radical* in that it can transform even the most enduring, stable and core aspects of a process without limitations or constraints. And it is *dramatic* in that improvement implies that the level of performance can be increased at a quantum level, as in twofold or more, rather than marginal improvements of five or ten percent. [Ref. 37:p. 7]

Reengineering embodies what is needed most to create the required changes to enhance Government acquisition, and the Davenport process innovation model is the

ideal tool. It is critical to now examine this process, as it is foundational to the results of previous research that this thesis builds upon.

3. Davenport Methodology

Davenport's framework for process innovation contains five major phases: identifying processes for innovation, identifying change levers, developing process visions, understanding existing processes, designing and prototyping the new process. Table 5 displays the process.

a. Phase 1: Identifying Processes for Innovation

The first step in the innovation process is to enumerate major processes. This enables the organization to identify process definitions and their impact on the organization as a whole. It is also foundational to ensuring that the process scope is manageable. The second step is to determine process boundaries so that process owners can comprehend where the process begins and ends, and the relationships between other processes and those inner sub-processes. The third step is to assess strategic relevance of each process to innovate those processes that are most in line with the organization's mission.

Innovation is a radical process that requires a great deal of coordination. Therefore, in cases of simultaneous innovation projects, the organization must also ensure that it has a complete understanding of the level of change and potential for upheaval. Once the strategy is assessed, then one must render high-level judgements of the "health of each process" in order to prioritize processes that are problematic and in need of

Table 5. Davenport's Process Innovation Framework [Ref. 9]

Phase I. Identify Process for Innovation
Enumerate major processes
Determine process boundaries
Qualify the culture and politics
Phase II. Identify Change Levers
Identify technological/human opportunities for process change
Identify potential constraining technology and human factors
Research opportunities
Determine which constraints will be accepted
Phase III. Develop Process Vision
Access existing strategy for direction
Consult with customers for performance objectives
Benchmark for targets and examples of innovation
Formulate process performance objectives
Develop specific process attributes
Phase IV. Understand Existing Processes
Describe process flow
Measure in terms of new process objectives
Assess the process in terms of new process
Identify problems with the process
Identify short-term improvements
Qualify the culture and politics
Phase V. Design and Prototype of the new process
Brainstorm design alternatives
Assess feasibility/risk and select the new process design
Prototype the new process
Develop a migration strategy
Implement new organizational structure

obvious improvement. Innovation should begin in the processes that receive the highest priorities. Finally, steps are taken to qualify the culture and politics of each process. This context is important because the organization needs a champion for process innovation and a strong commitment to follow through with the innovation, appropriately set within this context, if it is going to be a long-term success.

b. Phase 2: Identify Change Levers

The second phase of process innovation is to identify change levers. The first step is to identify potential technological and human opportunities for process change. Organizations must ensure that they focus on achieving a change through more than just one change lever, like information technology (IT) alone. IT must be viewed as one of several enablers of process innovation. [Ref. 9] Once these levers are identified, then one must identify potentially constraining technological and human factors to decide which constraining factors are accepted and what ones the organization will attempt to overcome. One also needs to analyze potential opportunities that would achieve organizational goals and innovate the process. The organization must look at enablers from all sides to ensure they reveal quantum improvements. The final step is to take the constraints identified at the top level and determine those that the organization attempts to overcome and, secondly, those that are to be left for later consideration.

c. Phase 3: Developing Process Vision

A clear purpose and vision are key if the innovation of the process is to succeed and become part of the organizational process and structure, as it must produce a

champion with a clear direction to "guide and inspire their process innovation." [Ref. 6:p. 1] The first step is to assess the existing business strategy for process directions. The organization's strategy should have an equal mix of measurable, specific, inspirational and long-term qualities. Consulting with customers during this step is paramount in the implementation of a highly successful process innovation change. The recipe to the success of process innovation for an organization is having a complete understanding of the customer's requirements and viewpoint. The organization should obtain outputs such as performance, flow and other encompassing process recommendations.

The organization then selects one or more companies to benchmark its performance. The organization must consider other firms that have similar processes, not necessarily those within the same industry. The organization then takes the process vision that is developed from the organization's strategy and develops process objectives. These objectives include the process goal, improvement desired, measurable benchmark and time to be completed. The final step is to develop descriptive and non-quantitative factors that satisfy both the process objectives and characterize the vision, generally categorized into characteristics such as technology, people and process outputs. Once this vision is fully developed, then it can move forward and properly innovate the existing system.

d. Phase 4: Understand Existing Processes

The key to success in the fourth phase is to have a good understanding of the process flow before a new one is designed. The first step of understanding existing

processes is to describe the current process flow on paper as it sets the stage for additional analysis. Understanding the current process flow requires quick but in-depth analysis, generally completed within a few weeks. This timely and visual description allows members of the process innovation team to understand all of their functions and how they interrelate.

The next two steps are to measure the current process in terms of performance objectives and to assess the quantitative objectives as identified in the process objectives and the attributes as laid out in the process vision. These steps give the process innovation team a quantitative look at the current process and provide indicators of "troubled" areas that can assist in developing a new process that meets the attributes of the process vision. Any deficiencies associated with the current process are identified with the applicable short-term solutions. By the end of this analysis, the current process should be clearly understood, including any supporting IT or other cultural and political aspects to the problem. [Ref. 9:p. 1]

e. Phase 5: Design and Prototype the New Process

The final phase of the process innovation cycle relies upon the creativity of the process innovation team and its ability to take the information gathered in the previous phases, to analyze it, and to synthesize that information into a new and better process. The process innovation team should include key members of the organization--those that are stakeholders in the process. The first step is to have the members of the design team freely share and brainstorm their ideas and propose design alternatives. Each

brainstorming solution should be analyzed for feasibility, risks and potential benefits. During the next step a small-scale prototype design of the new process should be tested within the organization. The designers focus on the *fit* of the new process in the structure, information technology and the organization. Once the designers look at the process *fit* within the organization during the testing phase, then the new process is refined and polished. This cycle of testing and polishing usually takes several iterations, but it helps to ensure a proper fit in the organization and allows for feedback from the user. [Ref. 9]

The next step is to develop a migration strategy depending on the size and overall impact of employing the new process. The organization may choose to phase in the program if full implementation is evaluated as too risky. A useful migration strategy may first strive to reach the easiest redesigns with the largest payoffs. Alternatively, changes in organizational structures and culture are fundamentally more difficult to achieve, but with phenomenal potential payoffs. The final step in Davenport's process innovation framework is to implement the migration strategy and process innovations. Once again, continuous process improvement (CPI) is a necessary ingredient in the recipe to success as it provides a means of allowing feedback and implementing necessary changes toward maturation. [Ref. 9]

4. KOPeR Method

The Davenport framework above provides clear guidelines for what to do in an innovation project (e.g., understanding the existing system, identify change levers, design prototype, a new process), but it has very little to say regarding *how* these steps should be performed. Dr. Nissen has augmented Davenport's work through the Knowledge-based

Organizational Process Redesign model (KOPeR), which provides tools and techniques for implementing and supporting Davenport's framework. [Ref. 9]

The KOPeR redesign method supports and augments the steps in Davenport's framework through eight primary activities. The organizational *process,* identified above, is first represented in terms of a computer-based *model.* This model provides a standardized representation on which a battery of graph-based diagnostic process *measurements* can be obtained automatically by KOPeR. The *diagnosis* activity then allows, and based on the measurements from above, it detects pathologies of the process and forms the basis for the subsequent activity of *predicting* what re-design transformations are most likely to effect dramatic improvements. These transformations are then applied to the baseline process model to *generate* one or more redesign alternatives for the process. Finally, once a dynamic process model has been validated and calibrated against the process baseline, simulation is employed to *test* the performance of each design alternative. These results are very effective and allow the *selection* of the highest alternatives for *implementation.* Figure 1 delineates the redesign method supported by KOPeR. [Ref. 39:p. 3]

This thesis draws upon the Davenport innovation process, as augmented by the KOPeR method, to redesign the standard procurement process, and it places particular focus on radically extending SPS through intelligent agent technology as a powerful change lever. This thesis also builds on prior work along these lines. Before designing IA technology, it first summarizes the findings from this prior work.

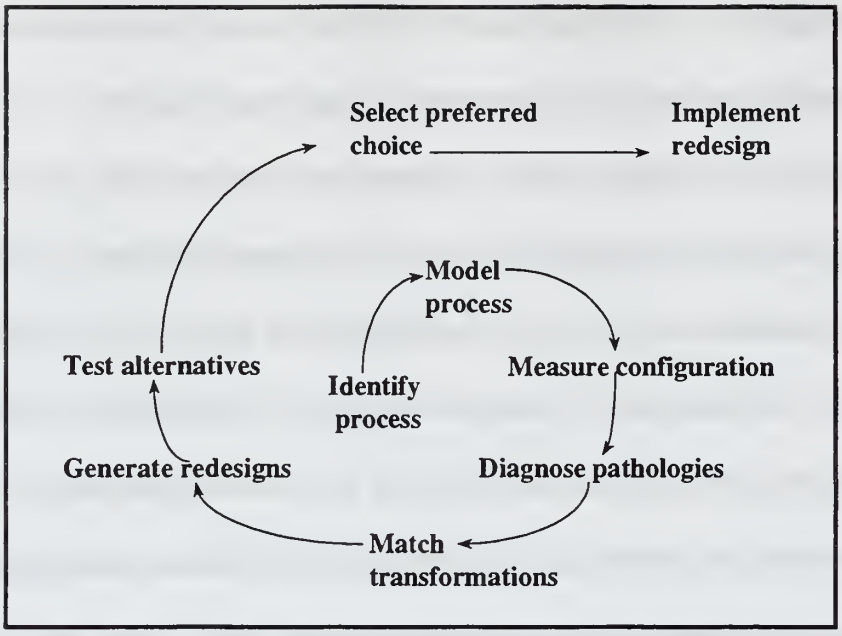


Figure 1. Knowledge-based Organizational Process Redesign (KOPeR) [Ref. 39]

5. Standard Procurement Process Innovation Results

McCarthy also used the Davenport process innovation framework, augmented with KOPeR, to analyze the standard procurement process for innovation. She concluded that simply automating the process would not bring about a quantum level of benefits. Following Davenport's methodology and the KOPeR tool, she described the standard procurement process flow, assessed the baseline process problems and designed a process alternative addressing these shortcomings. Measurements of the redesigned process show it to be a significant improvement over the existing process and to offer good potential for cycle time reduction. She recommended that further research be conducted, especially in the area of investigating further IT innovation. [Ref. 6:p. v] McCarthy concluded that there were six major process pathologies which contribute to the cost and cycle time, as listed below [Ref. 6:p. 103]:

- Many parallel functions—very sequential
- Multiple handoffs between participants—high process friction
- Various feedback fractions—inordinate amount of checking and complexity
- Poor IT support—still many manual process flows
- IT communication fraction—much paper-based communication
- IT automation fraction—very labor-intensive processes

Based on these findings, McCarthy recommended the following to innovate these critical areas: 1) decrease the number of sequential steps in the process, 2) reduce the number of handoffs and feedback loops, 3) increase IT support and IT communication, 4) increase IT automation. [Ref. 6:p. 113] Her model of the baseline process and its redesign are discussed in detail in Chapter III. Following McCarthy's recommendations, this thesis specifically addresses opportunities for innovation through intelligent agents.

E. INTELLIGENT AGENT (IA) TECHNOLOGY

Now that we have reviewed the background and issues of the Federal acquisition process, SPS, and reengineering, we must understand the fundamentals of IA and other advanced technology. Although a standard definition has yet to emerge, for purposes of this thesis an *IA* is defined as the use of advanced electronic decision making applications to perform routine programmed operations in expert systems. [Ref. 40] As a simple procurement example, an IA could be used to conduct market research, solicit proposals, negotiate prices, construct sections of a contract and monitor specified metrics, like PALT, protests, and deadlines. An IA can be instrumental in innovating these processes

to better suite the needs of the Government in the "virtual" age. Computer processing capacity and speed capabilities double every 18 months while the price decreases by 50%. With these trends, IA and the required infrastructure should be ready during the next decade.

1. Overview

Future Government acquisition innovation technology is already practiced in the commercial sector and prevalent on the Internet. CommerceOne is an example of a commercial firm that takes EC to a higher realm. [Ref. 40] It posts multiple acquisition items for sale and integrates them with a separate database of potential buyers. After a match is made, the two parties are linked together and given the appropriate EC documents, all automatically, allowing them to validate and conduct the transaction. Cutting edge technologies like this raises relevant questions regarding incorporating more advances. Yet how far should Government contracting go with technology? How is this accomplished and who does the work?

Research is being conducted to use IA, which is also commonly referred to as artificial intelligence (AI), in expert systems to reengineer the Federal procurement process. One research project produced a model for reengineering the Request for Proposal (RFP) process using knowledge-based systems, stating:

> The use and utility of knowledge-based systems to support process redesign are demonstrated, and insight is provided into the potential of AI-based technologies to dramatically improve military procurement. The results provide the basis for a number of conclusions that are important for the acquisition professional, and establish an agenda for future research. [Ref. 38: p. 87]

The application and means of IA continually progresses and its definition continues to change with time. Let us examine this progression. Many professionals considered spreadsheets, for example, to be IA fifteen years ago. Decision support systems (DSS) use basic logic oriented rule programming to assist in relatively simple determination processes like data mining, applications development and modeling. [Ref. 40:p. M-18] On a more advanced level, expert systems are programmed to make complex decisions, like in healthcare, finance, and marriage counseling applications. They use software that analyzes input data and render the best solution based on the "expert" knowledge coded into the system. [Ref. 40:p. M-21] Finally, the commercial sector uses basic AI-based technology in on-line search engines to conduct continual search, filter and retrieval of data. More mature IA applications are utilized in robotic and other advanced performative applications. [Ref. 40:p. M-31] A combination of these systems could make the majority of acquisition decisions and actions, if programmed to do so. [Ref. 42:p. 8]

a. Classes of Agents

Work in the area of IA has been going on for some time and it addresses a broad array of applications. To best employ IA into Federal acquisition, we need an understanding about the different classes of agents and how they work in different situations. The four classes of existing agents are [Ref. 42:p. 2]

- Informative filtering. Focused on the tasks such as filtering E-mail, network news groups and frequently asked questions.

- Information retrieval agents. Oriented to address problems associated with collecting information pertaining to commodities such as computer equipment, insurance and advertising, Internet robots and agents that perform indexing, information gathering and delivery.
- Advisory agents. Focused toward providing intelligent advice in applications such as electronic concierge, planning and support, military reconnaissance, financial portfolio management and computer interface assistance.
- Performative agents. Oriented toward functions such as business transactions and work performance, marketplace for agent-to-agent transactions, agent negotiation system, automated scheduling, cooperative learning and automated digital services.

b. Agent Framework

To help understand how these different classes of agents work, we draw from the work of Gilbert et al [Ref. 42] and Doctors Nissen and Mehra [Ref. 7] to discuss the agent capability framework depicted in Figure 2. This framework shows three distinct dimensions of an agent: collaboration, intelligence, mobility. Intelligent acquisition agents (IAA), those agents that are best equipped to conduct performative acquisition functions, are probably best summarized as more of a performative agent, but they exhibit the capabilities of the other classes. For example, they have been designed to exhibit behaviors such as filtering and retrieval, but their use can also be accomplished through simulation and work enactment. [Ref. 7:pp. 1-3]

Each of the three planes represents a "pure" archetype dimension. First notice that an IAA is on the mid-scale of each dimension. In general, many expert systems operate at the extreme of a formalized, expert-level intelligence, but they are not traditionally designed to be highly mobile or collaborative. Likewise, the mobile remote

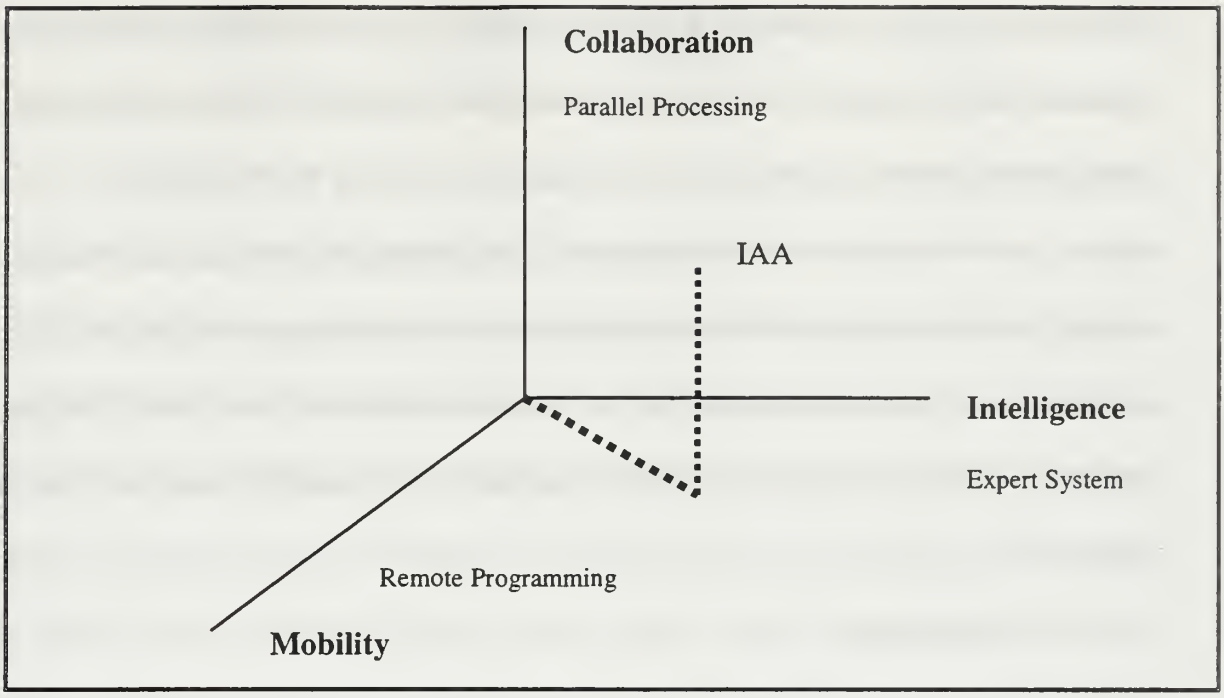


Figure 2. Agent Framework [Ref. 7, Ref. 42]

programming function of an embedded Java applet can equip programs to execute actions on extraneous machines, but agents in this class lack the intelligence and parallel processing functionality. So an IAA class is not as extreme as any of the three exemplars along any particular axis, yet they fall about in the middle of each. This is what gives the IAA the ideal balance of each and gives them their unique capabilities. [Ref. 42:p. 2]

By combining the power of advanced Internet search engine tools with the benefits of programming rational-decision-making of IAA, the end-to-end acquisition process could be "partially" automated. Just as the 80/20 rule that states that about 80% of our daily work are repetitive and routine in nature, a machine could "partially" conduct, for example, 80% of the most routine contracting functions. This could free the manager to perform the remaining of the higher level 20%, which might be approvals,

reviews, awards, etc. Although a great deal of effort is required to research and to write computer code to program even a small fraction of the regulations and processes, there is great potential for the future use of IA in acquisition innovation. [Ref: 38:p. 87]

There are several advantages and disadvantages of IA that the researcher explains before moving onto the methodology and data presentation of this thesis. This information is crucial to understanding the potential benefits and associated limitations and risks. The following sections are a synthesis of information based on various references.

2. Advantages

Dr. Nissen states that the primary advantage of IA-based technology is the potential to greatly increase productivity and reduce time. [Ref. 38:p. 87] AI should further increase resource utilization, creating better quality, competition and better value. Hopefully, another major plus for AI will be its open, comprehensive and accessible Internet-based blueprint. These benefits should be widespread and benefit all parties involved. IA has a great advantage in terms of knowledge management. For example, as the "graying" acquisition workforce begins to retire and leave the Federal service, some mechanism is required to capture and distribute their precious acquisition knowledge. [Ref. 4] The capture and distribution of knowledge represents a fundamental IA capability and advantage.

3. Disadvantages

The DoD will probably be unwilling to pursue widespread use of IA until further research is accomplished with functioning prototypes, but this reluctance should diminish

as time passes and technology advances. McCarthy states that cost and time delays are a major disadvantage. [Ref. 6:p. v] One can say with confidence that it will not be cheap to pay the programmers to write the rule-based code to implement all requisite regulations and multiple processes. But, as with any form of automation, once the software is written, computer programs generally run for many years at a fraction of the cost for people to perform the same work manually. One can also say with confidence that by the time such a system is created, the associated acquisition, laws and processes could have changed and the technology could be outdated or obsolete. So system maintenance and an open architecture are important. Further, training remains a significant issue that will require continual investment, and security violations pose a valid concern that must be seriously addressed with a comprehensive long-term plan. [Ref. 4]

F. SUMMARY

The DoD has come to terms that there needs to be more significant changes to *how* the Federal acquisition process is performed in order to compete in the global economy. Numerous acquisition reform measures have been instituted to facilitate employing successful commercial best practices to provide more flexibility in implementing measures to increase efficiency and effectiveness. SPS has been a good start, but significant progress is still required. Federal acquisition needs to be reengineered to better operate in today's electronic economy, taking advantage of the great enabling potential that IT offers.

Business process reengineering using advanced technology like IA is one way to implement these required changes for quantum enhancements. Simple automation is not the answer. Using the foundation set forth in the background literature review of the acquisition process, SPS, reengineering and the results of McCarthy's thesis, the researcher now moves to implement a specific methodology to further innovate the acquisition process using IA and other complementary IT. This methodology compares the functions of FAP and SPS, and proposes where advanced computer technology, specifically IA, can be implemented using the Davenport, KOPeR augmented approach.

III. METHODOLOGY AND DATA PRESENTATION

A. OVERVIEW

The researcher builds upon the Naval Postgraduate School thesis work of Major Teresa McCarthy, "Innovating the Standard Procurement Process." [Ref. 6] She used the Davenport process innovation framework to gather, group and analyze the capabilities of the Standard Procurement System (SPS). [Ref. 9] In her research, McCarthy finds that the standard procurement process, and specifically SPS, are ideal candidates for innovation. She concludes that there are six major process pathologies which contribute to excessive cost and cycle time: 1) many sequential functions that could be conducted in parallel, 2) multiple handoffs between participants that create high process friction, 3) considerable feedback that results in an inordinate amount of checking and complexity, 4) poor IT support in a system with many manual process flows, 5) dysfunctional IT communication that relies on paper-based correspondence, and 6) limited IT automation in a very labor-intensive process. [Ref. 6:p. 103]

McCarthy also finds four change levers available to address these pathologies: 1) decrease the number of sequential steps in the process, 2) reduce the number of handoffs and feedback loops, 3) increase IT support and IT communication, and 4) increase IT automation. [Ref. 6:p. 113] McCarthy then employs these change levers to redesign the standard procurement process. However, even her redesigned process continues to suffer from negligible IT automation.

This thesis continues to build on McCarthy's prior research. Using phases III-V of the Davenport process (i.e., develop process vision, understand existing processes, design and prototype a new process), we further analyze the standard procurement process, using McCarthy's redesign of the standard procurement process, with an explicit and direct focus on increasing IT automation as an enabler of process innovation. The specific enabler targeted for such IT automation is intelligent agent (IA) technology.

This thesis research includes an extensive Government and commercial literature review to gain information on the standard procurement process, the Federal Acquisition Process (FAP), SPS, the concept of process innovation, and IA. Government manuals and publications are reviewed for establishing the background and baseline methodology of the standard procurement process. Commercial and Government publications are examined for information regarding the evolution and implementation of SPS and process innovation with IA. This analysis includes interviews with acquisition professionals, IT experts, SPS creators and SPS users to form the "SPS Plus" vision. The specific innovation process used in this thesis is Dr. Nissen's KOPeR augmentation to Davenport's "High-Level Approach to Process Innovation." This innovation approach is effected through a top-down review of SPS, which provides a logical framework for analyzing how to innovate SPS using IA.

Chapter III logically follows the next two phases of the Davenport innovation model and is divided into two sections: 1) develop the process vision, and 2) create an understanding of the existing processes. It discusses, proposes and formulates performance enhancements of SPS using IA technologies to form a completely innovated

model, "SPS Plus." It is understood that this visionary proposal pushes the technology and acquisition reform envelopes in an effort to initiate momentum for future research and innovation of the entire Federal acquisition process. Chapter IV then follows this work and proposes a design and prototype of the new process, Davenport's fifth and final phase.

B. PROCESS VISION

Vision is essential for a business to have operational success. Developing vision represents a key element of business strategy, and alignment between strategies and processes is essential to effect radical and long lasting change in business practices. [Ref. 9:p. 117] Process change without strategy and vision seldom results in more than incremental reductions in time, cost and changes beyond basic streamlining. [Ref. 9:p. 119] This section develops the process vision for "SPS Plus," using the steps listed in Table 6.

Table 6. Phase III. Develop Process Vision [Ref. 9]

Step 1	Assess existing strategy for direction
Step 2	Consult with customers for performance objectives
Step 3	Benchmark for targets and examples of innovation
Step 4	Formulate process performance objectives
Step 5	Develop specific process attributes

1. Assess Existing Strategy

The first step of Davenport's innovation method in developing process vision is to assess the existing strategy for direction. Strategy is an essential element of any business that desires to have long-term success. Communication, risk management, teaming, forecasting, long-range planning, empowerment, fostering relationships, promoting competition, maximizing commercial products, training and education are all significant Federal acquisition strategies. [Ref. 44] This comprehensive strategy forms the vision and purpose of Federal acquisition and promotes further process improvement and innovation. This purpose of this vision is to continually improve in providing best value, by obtaining a quality product in a timely manner at the best price that meets the customers needs. [Ref. 19:p. 1-1]

The advent of electronic commerce (EC) and the growing virtual economy significantly affect the Federal acquisition strategy. More powerful computer and telecommunication capabilities allow businesses to operate at a much faster pace and reach a wider group of trading partners. The imposing implementation cost and learning curve to leverage EC mandate that businesses must have strategic vision to make this transition as innocuous as possible. Businesses must be willing to manage this risk if they want to reap the benefits that IT promise. To do this well, a process should be reengineered before it is automated. This requires a vision that promotes standard procedures, flexible IT infrastructures and the ability to manage inevitable challenges.

Federal acquisition is incorporating this vision into many of its reform initiatives. DoD is committing a significant investment into SPS as the cornerstone for bringing

acquisition into the EC economy, although other alternatives exist to enhance or even replace SPS. For example, the Naval Facilities and Engineering Command (NAVFAC) designed a purchasing program called the Field Office Consolidated Automation System (FOCAS) for only $1 million. FOCAS performs many of the same functions as SPS, yet on a smaller scale. NAVFAC "unplugged" SPS earlier this year, replacing it with FOCAS and offering free copies on the Internet. [Ref. 46] In a similar situation, a contracting officer from the Naval Surface Warfare Center stated that he could add to the functionality of their prototype with commercial software and, in less than one year for only $10 million, match and out-perform the functionality of SPS. [Ref. 46]

These are viable alternatives to SPS that can be combined with IA. Together, they offer potential, radical time and cost savings that can empower and free-up personnel to perform higher-level activities, rather than routine or programmable functions that the computer can accomplish. The "SPS Plus" vision should include a strategy that promotes IT creativity--one that focuses on using better communication infrastructures, like the more accessible and affordable web-based Internet systems, and specific enabling technologies, like IA.

2. Consult with Customers for Objectives

The second step in developing process vision is to consult with process customers. Obtaining customers' perspectives on the process, both internal and external, can generate new ideas and process objectives. The types of input that should be gathered from customers should be extensive and include process outputs, performance, flow, enablers

and other relevant forms. [Ref. 6:p. 124] These performance objectives provide the direction for how to develop the appropriate new process vision and strategy.

For years internal customers have commented that Federal acquisition processes should definitely be improved. SPS is now a primary means to accomplish this. However, implementing SPS has created a huge learning curve with many problems and delays, ranging from menial printing glitches to security access violations. [Ref. 45, Ref. 46] Even as users become more familiar with its use, more problems continue to surface and many feel that SPS does not perform as well as previous systems. For example, one case showed that SPS inconsistently generated automatic clauses. Two users entered the same contract data and produced different contract clauses. [Ref. 46] Such problems have created much debate about the wisdom of imposing such a large IT effort.

External customers predominately voice that the major problem with Federal acquisition is time delays. SPS is intended to speed up the process. For example, final payments on contracts are often delayed for over a year for many large purchases. SPS does not handle small purchases bought with credit cards, which account for 97% of all transactions. [Ref. 47] Not only this, but SPS cannot be used to acquire a major weapon system, like a submarine or an aircraft. SPS will not implement greater payment and major system functions until version 5.0. A 1998 report from DoD's Office of Test and Evaluation found vulnerabilities in the system's security as unauthorized users gained access and altered solicitation and contract documents. [Ref. 45] These events call for a reduction in such internal and external problems. Input from customers is critical to the development of a better process vision with specific IA-enabling performance objectives.

3. Benchmark for Targets and Examples

One of Davenport's fundamental elements for formulating new process objectives is benchmarking. Benchmarking is an effective tool for identifying innovative process attributes and determining process objectives. Performance objectives are determined by comparing the SPS process and systems to the vision enabled by IA. [Ref. 6:p. 86] SPS was created out of a benchmarking effort that integrated Defense functionality into a successful commercial application. Today, commercial industry is relying less on EDI and more on web-based Internet systems. This seamless infrastructure allows for more use of IA, which can radically enhance and innovate SPS. As Gebauer et al. state, technology is greatly shaping the way business is conducted and, subsequently, its strategic visions: [Ref. 43:p. 167]

> (The) Internet and related technologies will change the role of the purchasing department from a transaction-oriented function to a more managerial function focused on establishing and maintaining relationships with suppliers, third parties, and internal customers, and leveraging corporate buying power. In its new role, procurement will also manage the technological infrastructure necessary to either automate transactions fully or to empower end users to perform many transactions without the direct involvement of the purchasing personnel.

These benchmarks are changing the market place and need to be incorporated into the "SPS Plus" vision. As detailed in Chapter II, the primary enabling technology of this thesis is IA. However, SPS benchmarking aspects should also include related Internet-based procurement systems—to ignore them would be foolish. These features present the

potential to support all aspects of procurement and need to be incorporated in the vision, including: [Ref. 43:pp. 171-173]

- The number of Internet users is growing steadily. The Internet is becoming a very flexible and powerful method for organizations to connect with business partners and to access information electronically.
- Internet and Web-enabled technologies not only make information available to others instantly; they also facilitate instant interactivity, especially when compared with traditional communication media and electronic systems like EDI.
- The Internet supports the exchange of information in a broad variety of formats, ranging from text and graphics to sound and video clips, which enables the transmission of very complex information.
- The Internet's open standard and architecture manifested in platform independent browser technology helps to overcome the limits of proprietary and closed systems by facilitating data processing and exchange across different technology platforms and different performance capabilities. Web browser-based point-and-click interfaces are "end-user-friendly."
- Internet search engines help users find items by using keywords supporting the information phase, in particular to find new sources or to fulfill unexpected requirements.
- Internet-based catalogs allow buying organizations to browse, search, and place orders on-line.
- Internet-based EDI links can be less costly than the traditional leased lines and value added service providers regarding network access and data transmission.
- Internet-based on-line auctions and bidding systems support the negotiation phase by providing a simple negotiation mechanism confined to price alone.
- Maintenance, Repair and Operation (MRO) procurement systems let buyers combine catalogs from several suppliers, check the availability of items, place and track orders and initiate payment over the Internet.

4. Formulate Performance Objectives

Following this benchmarking process, Davenport's next step is to formulate the process performance objectives by asking the question "what business objective is the process supposed to accomplish?" The answer to this question should address the functions and values that the process is expected to produce. These process directives should be derived from the strategy and they must be quantified for specific targets for change. This type of change must be radical, such as reducing cycle time by 50% or double cost avoidance, not a mere 5-10% differential. [Ref. 9:p. 128]

SPS is projected to reduce time and save money in the long run, but not at these radical levels. The primary objective of SPS is to standardize and automate the Defense acquisition system by 1 January 2000. The supporting secondary objectives set in 1998 are to reduce: 1) administrative cost by 50% over the next three years, 2) paperwork by 100% over the next two years, 3) cycle time by 50% over the next two years. [Ref. 1:pp. 100-104] Such results have not been achievable to date; in fact, prior research on the effects of workflow technology, such as SPS, suggest process cost can actually increase utilizing IT-based changes along these lines. [Ref. 4:pp. 467-476] The vision of "SPS Plus" must incorporate more radical yet achievable objectives as mentioned.

5. Develop Specific Attributes

Davenport describes process attributes as descriptive, non-quantitative precursors to process objectives, constituting a future vision of the process operations. Process attributes are simple statements that describe an organization's philosophy and objective of its process operations. An example of an organizational attribute is to collapse the

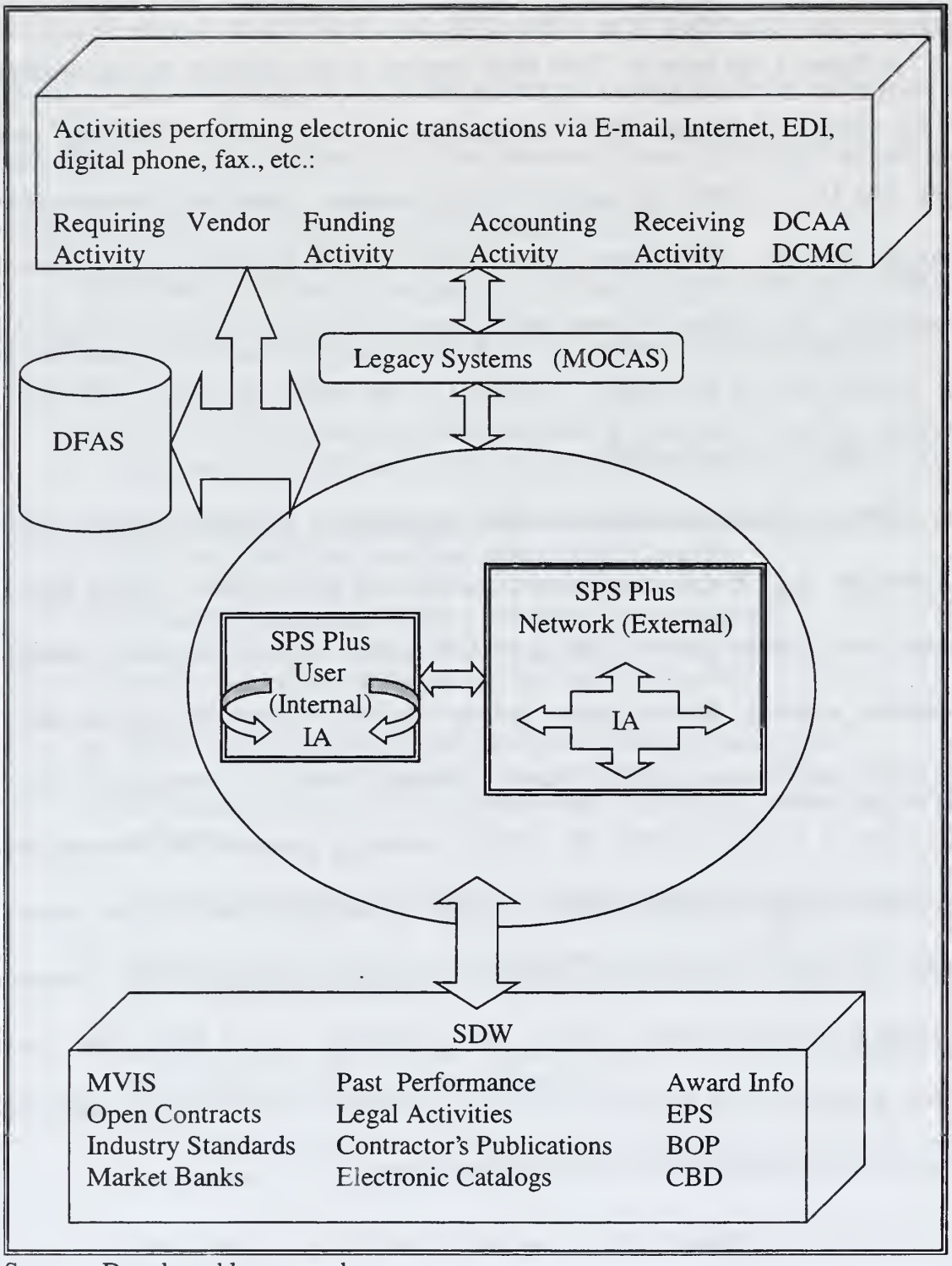
division of labor process in such a way as to empower a single employee to oversee a project. A classic example of this is Federal Express using handheld transmitters that relay up-to-minute delivery data to a central communications network that customers can access to track the status of a package. [Ref. 9:pp. 129-130]

"SPS Plus" mirrors and encompasses the specific process attributes of SPS, plus the addition of IA, which includes: [Ref. 1, Ref. 6:p. 92, Ref. 25, Ref. 48, Ref. 49]

- Add IA and automate applicable acquisition functions to free-up acquisition personnel to focus on more value-added functions.
- Link all supply, contracting and finance offices to customers via "SPS Plus" into a comprehensive, one-stop virtual acquisition entity.
- Expand SPS to manage all PRs, including micro-purchases.
- Empower employees by increasing contractual authority.
- Allow customers to obtain real-time data on-line for transactions.
- Infuse the seamless use of the Internet to all "SPS Plus" internal and external customers.
- Increase the access to "SPS Plus" by using any entry point via the Internet.
- Establish a security system commensurate with the users' authority and the subject matter's classification.
- Provide a secure and *auditable* digital "paper trail" for all transactions, from requirement inception to payment closeout.
- Add virtual support and training that are integrated to provide needed education and technical problem solving.
- Ensure that all procedures, forms and reports are standard and that data are easily shared.
- Accommodate as many external systems with dissimilar IT infrastructures as possible.

In Figure 3, the heart of "SPS Plus" consists of two elements that are enabled with IA: internal and external "SPS Plus" networks. First, the internal "SPS Plus" user station uses IA to conduct the majority of the redundant, clerical and programmable acquisition functions. These agents perform tasks within the acquisition shop's network of computers. Second, there are those external agents who not only function outside the local network, like on the Internet, but also function within the greater "SPS Plus" network connected throughout DoD.

Electronic transactions, not necessarily accomplished with the assistance of IA, are conducted (e.g., E-mail, the Internet, current EDI infrastructures, digital phone, facsimile) with different players in the process, to include requiring, supplying, funding, and auditing activities. Existing legacy systems are used to bridge the implementation process and reduced to one, MOCAS listed in Chapter II, which is eventually eliminated or set aside as a back up. [Ref. 29] DFAS accounting functions are electronically conducted externally to facilitate security. Finally, external performative agents conduct multiple data mining functions with numerous shared data warehouse (SDW) systems, like material visibility systems (MVIS), past performance, award history and open contracts databases, legal activities, contractor's publications, market banks, electronic catalogs, industry standards, CBD, BOPs, EPS, and others.



Source: Developed by researcher.

Figure 3. "SPS Plus" Vision

6. Process Vision Summary

This thesis uses a process innovation model to analyze SPS for innovation opportunities with IA. Site visits, interviews and literature reviews are conducted to analyze SPS. The researcher analyzes one of the four change levers recommended in McCarthy's thesis to innovate SPS, focusing specifically on IA. Through phase III of the Davenport innovation model, we develop a compelling new vision for the standard acquisition process.

"SPS Plus" represents a comprehensive virtual acquisition world that supports the strategic vision of Defense acquisition. This vision is to continually improve in providing for the best value in acquiring goods and services. A reengineering of SPS with advanced IT technologies promotes the Defense acquisition strategies, like better communication, risk management, teaming, training and education. "SPS Plus" allows an authorized user to seamlessly navigate throughout their domains, tasking intelligent agents to conduct the more routine acquisition functions. This allows acquisition personnel to share more data and to perform more specialized, complex and "high touch" functions, like managing relationships, approving major purchases and developing improvements. IA can be tasked to operate internally within the software application of SPS and externally to other destinations, like electronic catalogs, the CBD, DFAS, and others. These strategic goals of the Federal acquisition community are the basis for this new process vision and are essential for redesigning SPS with IA.

C. UNDERSTANDING EXISTING PROCESSES

As noted above, this section continues with phase IV of the Davenport innovation model to understand the existing processes. Describing an existing process is central to the purpose of process communication, and analysis of such a process baseline represents an excellent source of innovation opportunities. The six steps listed in Table 7 are used to organize, guide and conduct the analysis of this section. [Ref. 9:p. 139]

Table 7. Phase IV. Understanding Existing Processes [Ref. 9]

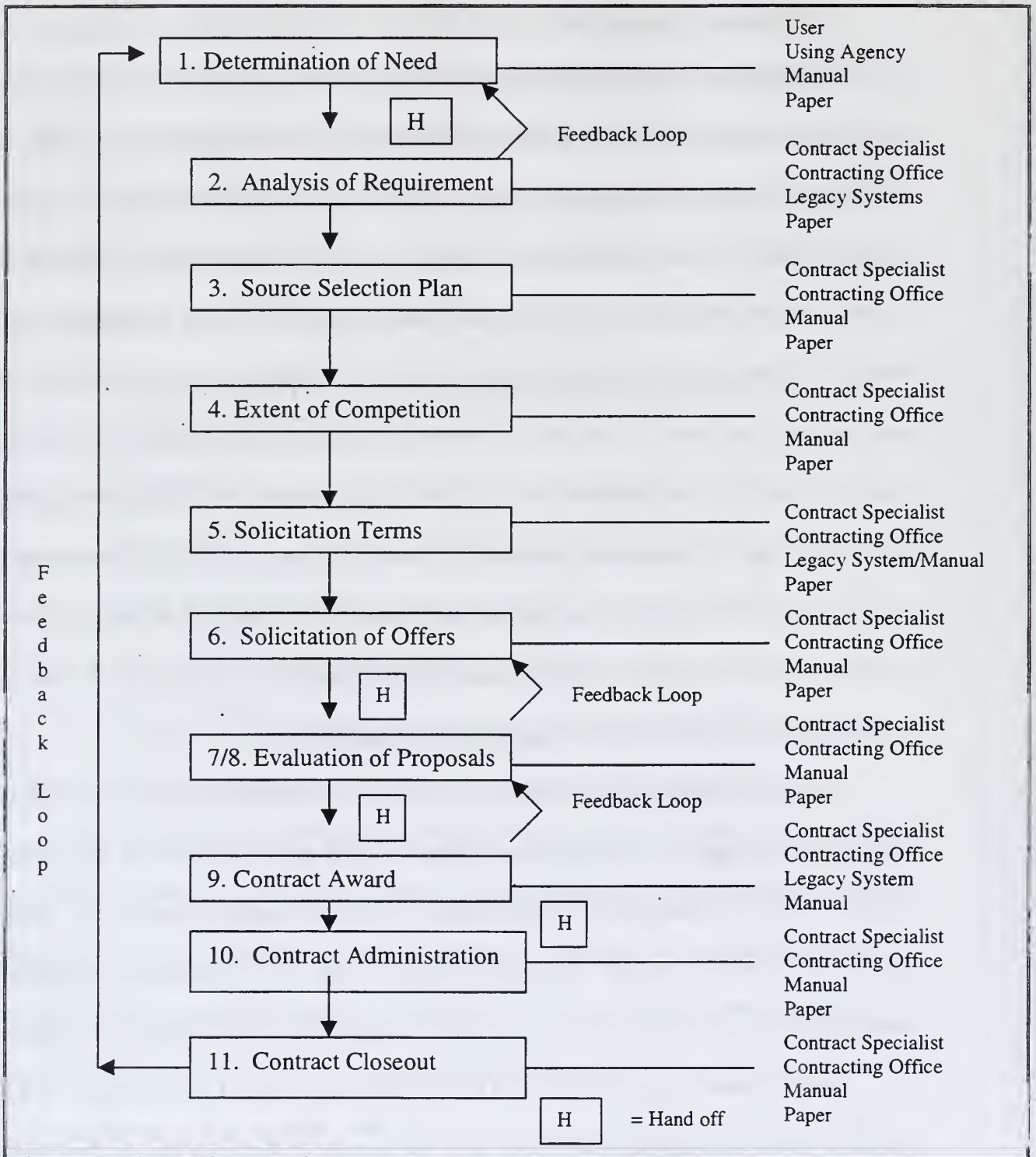
Step 1	Describe process flow
Step 2	Measure in terms of new process objectives
Step 3	Assess the process in terms of new process
Step 4	Identify problems with the process
Step 5	Identify short-term improvements
Step 6	Qualify the culture and politics

This thesis follows and extends the prior research of McCarthy. Several steps in the Davenport model do not lend themselves to a detailed examination. Since it is only a model, these steps are tailored to meet the purpose of the research: to address specific IA aspects of the standard procurement process. The first three steps--describe, measure and assess the process flow--are the key data collection elements of this thesis and receive heavy emphasis in the sections that follow. The other three steps--identify problems, short-term improvements and the culture and politics--provide useful information, but they are not given the same heavy emphasis and are only briefly mentioned for reference.

1. Describe Process Flow

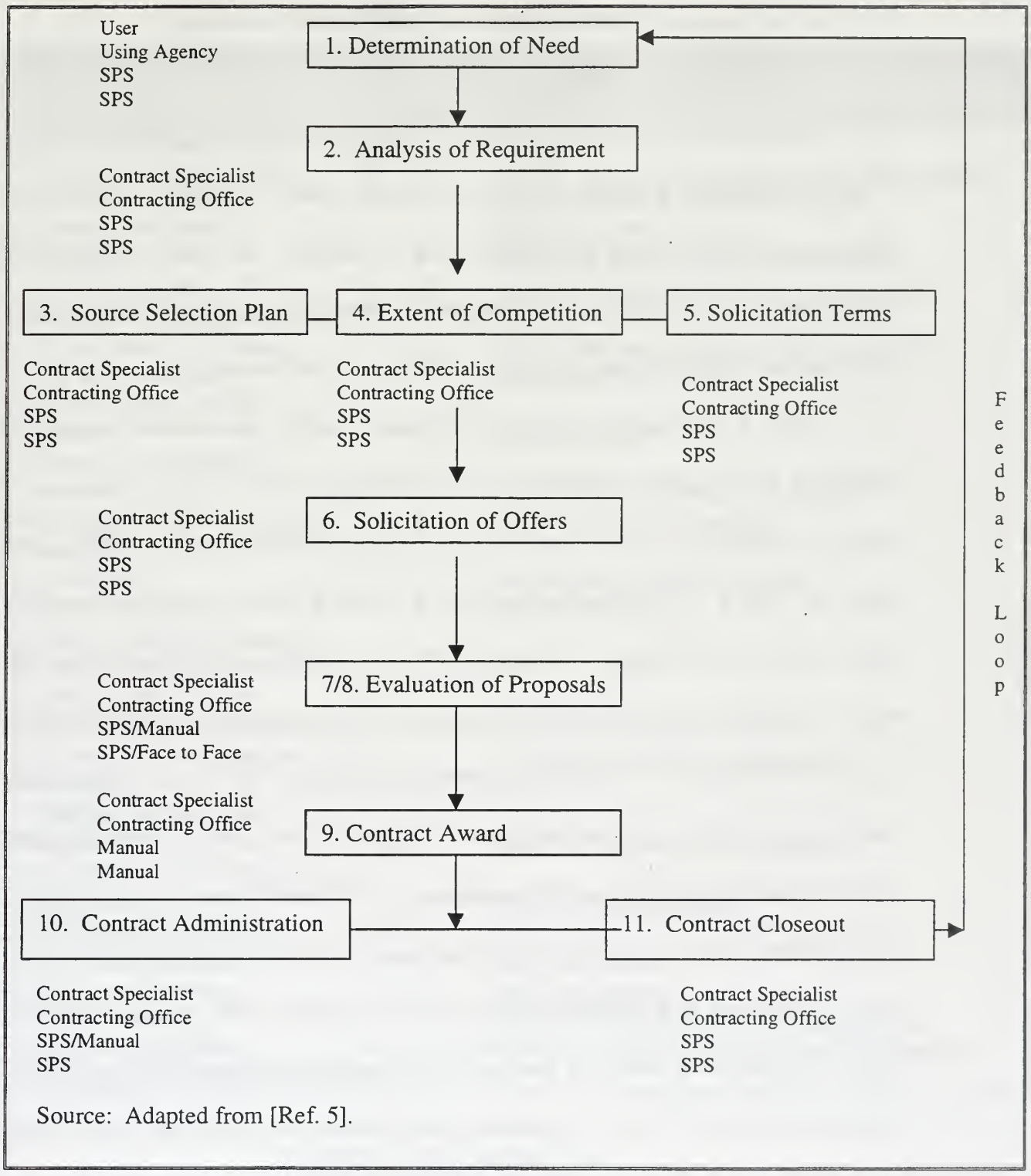
The first step in understanding the existing process is to describe the process flow. Let us first examine McCarthy's baseline and redesign of the acquisition process. First of all, Figure 4 represents the general sequence of the 85 steps detailed in the FAP, as seen earlier in Table 2. Second, as previously mentioned, McCarthy identified six pathologies in the standard procurement process, and specifically SPS. Figure 5 represents the redesign of the process incorporating three of the four change levers she identified to innovation: 1) decrease the number of sequential steps in the process, 2) reduce the number of handoffs and feedback loops, 3) increase IT support and IT communication. McCarthy's fourth change lever, increase IT automation, was not used in the redesign, which is the crux of this thesis. Both figures have been simplified to address those functions within the scope of this thesis. Specifically, Step 8, Evaluation of Bids, is removed as the sealed bid method is ignored in this analysis.

In these detailed process diagrams, each task is represented by a text box that is linked to the next task in a simple linear fashion. Listed next to each task is its process attributes, which include pertinent characteristics that are involved in each task. Each step has the four following characteristics: Role (e.g., user, contracting specialist, contracting officer), Organization (e.g., supply, agency, contracting office), IT support (e.g., word processor, legacy system), IT communication (e.g., LAN, E-mail). This graphical model also lists feedback loops (e.g., the process of requiring data to flow back to an earlier point), and handoffs (e.g., the process of requiring that an additional participant of higher authority validates the decision). [Ref. 6:p. 98] The 85 steps of the



Source: Adapted from [Ref. 5].

Figure 4. McCarthy's Baseline Process



Source: Adapted from [Ref. 5].

Figure 5. McCarthy's SPS Redesign

fall under their respective elements and are addressed later in this section.

2. Measure and Assess the Process

Once the process flow is detailed, it is essential to measure and assess it in terms of the new process objectives, steps two and three. [Ref. 6:p. 140] As previously discussed, McCarthy used the KOPeR tool to measure and assess the standard procurement process. Building upon McCarthy's research, the researcher now depicts what functions of the FAP are included in the SPS model for innovation.

Table 8 graphically presents the existing standard procurement process by comparing the acquisition baseline to the functionality of SPS. For reference, the baseline is comprised of the 85 steps of the Federal acquisition process (FAP), listed earlier in Table 2. The comparison presented in Table 8 indicates what functions SPS does and does not automate. Accessing SPS and determining if SPS performs that Federal acquisition step derives this information. This is marked in the second column (e.g., SPS Performs) by a "+" if SPS automates the function, a "0" if it only supports that function, or a "-" if it does not automate or support it. As an aid to traceability and follow-on research, the source of information (e.g., SPS menu, function name) is listed in the right-hand column next to those SPS functions graded with a "+" or a "0". An IA expert, an in-house SPS professional and an SPS user validate both questions. [Ref. 50, Ref. 51] Appendix B details the functions of SPS and clarifies the notation used in the reference column of Table 8. In addition, nine functions are outside the scope of this thesis and are annotated "Not applicable" (N/A), like for services and sealed bidding.

Table 8. SPS Functions in the FAP

Phase I. Acquisition Planning		
FAP Function	**SPS Performs?**	**Reference Notation**
A. Determination of Need		
1. Forecasting Requirements	0	Util-SA-Reports-Cognos Impromptu & Powerplay
2. Acquisition Planning	0	Proc-Milestone & Workload reports
3. Purchase Requests	+	Proc-Rqmnt-PR Form
4. Funding	0	SA-Funds & Proc-PA/A-Certify Funds
5. Market Research	0	Proc-PA/A-Solic-SML (Vendor data base)
B. Analysis of Requirement		
6. Requirements Documents	+	Proc-Attachment & Rqmnt-MIPR & CDRL
7. Use of Government Property/Supply Sources	+	Proc-PA/A-Auto Order
8. Services	N/A	Not applicable
C. Extent of Competition		
9. Required Sources	0	Proc-PA/A-Solic-SML & Proc-CBD
10. Competition Requirements Unsolicited Proposals	0	Proc-PA/A-Solic (manually)
11. Set-Asides	+	Utilities-Set Asides & Buy USA
12. 8(a) Procurements	+	Utilities-Set Asides
D. Source Selection Planning		
13. Lease vs. Purchase	-	
14. Price Related Factors	-	
15. Non-Price Factors	-	
16. Method of Procurement or Purchasing	0	Proc-PA/A-Award (Suggests contract type)
E. Solicitation Terms & Conditions	+	Proc-PA/A-Award (builds contract)
17. Contract Types— Pricing Arrangements	0	Proc-PA/A-Auto Order
18. Recurring Requirements	-	
19. Unpriced Contracts	0	Progress payments
20. Contract Financing	0	Delivery payment
21. Need for Bonds	0	Proc-PA/A-Certify funds & prompt payment
22. Method of Payment	+	Proc-User Workload & Workload Mgmt reports
23. Procurement Planning		

(+) = SPS automates and performs
(0) = SPS only supports
(-) = SPS does not automate and support

Table 8. SPS Functions in the FAP (continued)

Phase II. Contract Formation		
FAP Function	**SPS**	**Reference**
F. Solicitation of Offers		
24. Publicizing Proposed Contract Actions	+	Proc-CBD & EDI
25. Oral Solicitation	-	
26. Solicitation Preparation	+	Proc-PA/A-Solic
27. Pre-Award Inquiries	+	Proc-PA/A-Solic- PA Survey
28. Prebid/Prequote/ Preproposal Conferences	-	
29. Amending/ Canceling Solicitations	+	Proc-PA/A-Solic-Amendments and Cancel
G. Bid Evaluation		
30. Processing Bids	N/A	Not applicable
31. Bid Acceptance Periods	N/A	Not applicable
32. Late Offers	N/A	Not applicable
33. Price Analysis —Sealed Bidding	N/A	Not applicable
34. Responsiveness	N/A	Not applicable
H. Proposal Evaluation		
35. Processing Proposals	+	Proc-PA/A-Offer Evaluation-
36. Applying Non-Price Factors	0	Version 5.0
37. Price Analysis-Negotiations	0	Offer Evaluation (Price Analysis)
38. Pricing Information From Offerors	+	Proc-PA/A-Offer Evaluation
39. Audits	+	Proc-PostAward/Award-Audit tracking
40. Cost Analysis	-	
41. Evaluating Other Offered Terms/Conditions	0	Proc-PA/A-Offer Evaluation
42. Award Without Discussions	+	Proc-PA/A-Auto order
43. Communications/Fact-finding	+	Utilities-Document Import-Tech. Evaluation
44. Extent of Discussions (Competitive Range)	0	Business Clearance Memo/Source selection plan and other documents as contract file attachments
45. Negotiation Strategy	0	Business Clearance Memo/Source selection plan and other documents as contract file attachments
46. Conducting Discussions/Negotiations	-	

Table 8. SPS Functions in the FAP (continued)

Phase III. Contract Administration		
FAP Function	**SPS**	**Reference**
I. Contract Award		
47. Debriefing	-	
48. Responsibility	+	Proc-PA/A-Offer Evaluation
49. Subcontracting Requirements	0	Proc-PA/A-Offer Evaluation
50. Prepare Awards	+	Proc-PA/A-Offer Evaluation-Award
51. Issue Awards & Notices	+	Proc-Award-Release & EDI Transmit
52. Mistakes In Offers	0	Offer Evaluation (Pricing errors identified)
53. Protests	+	Proc-PostAward-Vendor Dispute Tracking
J. Initiation of Work and Modification		
54. Contract Administration Planning	+	Proc-PostAward-CDCS & Status tracking
55. Post-Award Orientations	-	
56. Consent to Sub-contracts	-	
57. Subcontracting Requirements	0	Utilities Auto tracking CLINS
58. Contract Modifications	+	Proc-PostAward-Modification
59. Options	+	Proc-PostAward Options
60. Task & Delivery Order Contracting	+	Proc-PostAward-Award & Utilities-Issue Tracker (IDIQ functions)
K. Quality Assurance		
61. Monitoring, Inspection, and Acceptance	+	Proc-PostAward-Award Status & Vendor Performance & Delivery & Discrepancy reports
62. Delays	0	Proc-Milestone
63. Stop Work	0	Proc-PostAward-Termination (and partial)
64. Commercial/Simplified Acquisition Remedies	0	Utilities-Auto Tracking (file attachments)
65. Noncommercial Remedies	N/A	Not applicable
66. Documenting Past Performance	+	Proc-PostAward -Vendor Performance and Version 5.0

Table 8. SPS Functions in the FAP (continued)

Phase III. Contract Administration (cont.)		
FAP Function	**SPS**	**Reference**
L. Payment & Accounting		
67. Invoices	+	Utilities-history files & Issue Tracker
68. Assignment of Claims	+	Utilities-Claims tracking
69. Administering Securities	N/A	Not applicable
70. Administering Financing Terms	N/A	Not applicable
71. Unallowable Costs	-	
72. Payment of Indirect Costs	0	Utilities-SA-Funds
73. Limitation of Costs	+	Utilities-SA-Funds
74. Price and Fee Adjustments	0	Proc-PostAward-Payment and Payment Requests
75. Collecting Contractor Debts	+	Utilities-SA-Funds
76. Accounting & Estimating Systems	0	Utilities-SA-Funds
77. Cost Accounting Standards	N/A	Not applicable
78. Defective Pricing	0	Organization Management (tracking violations)
M. Special Terms		
79. Property Administration	0	Version 5.0 (GFE tracking)
80. Intellectual Property	-	
81. Administering Socio-Economic/Misc. Terms	-	
N. Contract Closeout or Termination		
82. Claims	+	Proc-PostAward-Vendor Dispute Tracking
83. Termination	+	Proc-PostAward-Termination
84. Closeout	+	Proc-PostAward-Closeout
85. Fraud & Exclusion	0	Utilities-Auto tracking of protests and vendors can be excluded from source data base & ability to tie CLINS to Cure Notices, audits and disputes

Source: Developed by researcher.

Notice from the table that SPS is graded with a "+" for 33 of the 76 graded functions of the FAP. In general, these functions pertain to acquisition document formation and management actions that SPS performs *well*. Contractual information is sequentially formed as the SPS user progressively inputs data. Appropriate information is

pulled from the originating document, like a purchase request (PR), and automatically placed into the correct format to the next document, like a request for quotation (RFQ). These documents can be moved electronically to other SPS users on the network or external to SPS via EDI. SPS supplements these types of automated functions with a series of checks and balances. For example, a dialog box is prompted by a logical progression in forming the contract, such as informing the user to choose from a group of selected clauses. There are also authority levels built into SPS to ensure that appropriate personnel are conducting requisite contractual actions. For example, the system administrator sets who has authority to approve certain types of contracts. A user (e.g., contract specialist) that does not have approval authority must send the document to the appropriate person (e.g., contracting officer). These functions are predominantly repetitive and routine in nature.

Table 8 indicates a "0" grade for 28 FAP functions. SPS does not *fully* automate the majority of these steps, because they rely upon more personal intuition and experience from the upper-level user to process. However, these functions do indirectly facilitate and support that acquisition function. These functions can be segregated into three groups. The first group consists of those reports that the user can generate and tailor to meet specific needs. SPS does not automatically produce and conduct in-depth analysis of pertinent data. For example, the user must generate, analyze and take action based on the Workload Management report in order to enhance acquisition planning. The second group of functions includes those that prompt the user to take additional steps, like recommending a contract type. These prompts do not perform the task, but they do

provide essential guidance for a task that may otherwise be overlooked. Third, the researcher grades those functions that are not implemented in the current version of SPS, like property management and price analysis. It is impossible to determine to what degree future versions of SPS may automate these functions at this time.

Finally, the remaining 14 functions receive a "-" grade. In general, SPS does not perform these functions, either because they require more personal interaction or they are too complex to automate, such as negotiations and oral solicitations. The majority of these functions are also outside the "simplified acquisition" scope of this thesis, for example service, construction and large purchase actions. However, just because these functions are graded with a (-) does not indicate that they are not candidates for innovation with IA.

Chapter IV analyzes each of the functions listed in Table 8, regardless of grade. Before progressing, the remaining three secondary steps of Davenport's innovation framework issues are briefly mentioned and personify issues brought up in previous chapters.

3. Secondary Processes

a. Identify Process Problems

Once the old process is measured and assessed, one should consider what problems already exist. This is to ensure that the pathologies are not ignored in the redesign. If the problem is ignored, then the effectiveness of the SPS innovation may be significantly degraded. As discussed in previous chapters, the two major problems with

SPS are its enormous cost and its technical challenge associated with automating and standardizing all of Defense acquisition. Another problem is that current IT communication technology is not fast enough to handle the comprehensive nature of the "SPS Plus" vision. In addition, prototypes of IA-enabled acquisition systems are few in numbers and may be considered to be in their infancy stage. [Ref. 7, Ref. 42]

b. Identify Short-term Improvements

The next innovation step is to identify short-term improvements to alleviate problems. This allows long-term innovation measures to begin by decreasing the amount of detrimental effects caused by the existing problems. In order to reengineer an IA-automated version of SPS, the first action that needs to be accomplished is more research. Specific IA applications need to be developed. This entails that acquisition and IA experts collaborate and design functional applications to those aspects of the acquisition process that make the most sense and offer the largest return on investment. A fully functional prototype should be designed and tested at an actual SPS site before committing to additional applications.

Another more controversial solution is to remove the Defense mandate to implement SPS, possibly by narrowing the scope of implementing SPS. [Ref. 46] This will not be an easy task to accomplish, considering the investment and momentum of the project. Yet it will allow those commands that are already paper-less to continue using their legacy systems. For example, the Defense Energy Systems Command uses the Fuels Automated System, (FAS), a commercial fuel purchasing program that performs the

majority of required tasks adequately in that niche application. [Ref. 50] Why force a new system like SPS on them now? Do they need to be integrated with the other agencies? AMS could then focus more on fixing problems than fielding more sites. If DoD allowed commands to use different systems, like FOCAS, resources could be re-allocated to developing a better system. The question then arises if the result would then be a "standard" acquisition system. These short-term improvements provide useful insight into the complete innovation of SPS and help to reduce the problems.

c. Qualify Culture and Politics

The last step in the Davenport innovation method of understanding existing processes is to qualify the culture and politics. With these problems and short-term improvements in mind, this is important because a failure to do so will result in an inevitable decrease in the success of the innovation. Defense acquisition is often a complex, expensive and labor-intensive conglomeration of multiple players with competing priorities. In general, nothing happens easily or quickly. One must expect that this environment will be the same for an acquisition reform instrument that includes more automation, especially one using IA that is misunderstood and in its infancy.

D. SUMMARY

This thesis uses the Davenport model to analyze IA applications to innovate SPS. Site visits, literature reviews and interviews are conducted to analyze SPS. McCarthy's thesis identified six deficiencies in SPS and four change levers to mitigate them. This thesis focuses on her specific finding to increase IT automation; the researcher proposes

thesis focuses on her specific finding to increase IT automation; the researcher proposes to innovate SPS by incorporating IA. Section B of this chapter follows phase III of the Davenport innovation model, develop a process vision, based on McCarthy's findings of the first two phases. The vision of "SPS Plus" represents a comprehensive virtual acquisition world that supports the Defense acquisition strategy. This vision is the basis for developing a new process vision, which is essential for innovating SPS with IA.

Section C then documents phase IV of the Davenport innovation process, understanding the current process. For the vision of the proposed innovation to be successful, it is imperative to capture the existing process. Without this knowledge, the new process has no foundation on which to build. The functions of the FAP are detailed and compared against the SPS processes.

To ensure that reality tempers these assessments, previously mentioned issues are recapitulated. Problems are discussed and short-term improvements are recommended. Finally, the researcher qualifies the impeding political and cultural environments that the redesign and prototype processes will face.

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IV. REENGINEERING SPS

A. OVERVIEW

This chapter continues with the fifth and final phase of Davenport's innovation model, which is to design and prototype the new process, as listed in Table 9. The researcher analyzes the data presented in Table 8 from Chapter III and systematically looks for opportunities to employ intelligent agent (IA) technology as a viable reengineering tool for innovating the Standard Procurement System (SPS). The researcher first addresses all applicable functions of the Federal Acquisition Process (FAP) to brainstorm design alternatives. Second, the researcher focuses the analysis by assessing the feasibility and risk of the IA candidate in order to select the new process design. The chapter concludes with a prototype of the new process.

Table 9. Phase V. New Process Design and Prototype [Ref. 9]

Step 1	Brainstorm design alternatives
Step 2	Assess feasibility/risk and select the new process design
Step 3	Prototype the new process

B. DESIGN AND PROTOTYPE OF THE NEW PROCESS

1. Brainstorm Design Alternatives

The first step of Davenport's phase V is to brainstorm design alternatives. Brainstorming is an essential innovation task that relies upon the creativity of the process innovation team. It draws upon people's ability to take information gathered in the

previous phases, analyze it, and synthesize that information into a enhanced process. The key stakeholders on the process innovation team should freely share and brainstorm their ideas and propose innovative design alternatives. [Ref. 9:p. 106] This process is based in part on process actions and corrections recommended in McCarthy's redesign [Ref. 9:p. 107] and with ideas developed by the researcher as a result of in-depth literature review, site visits and analysis.

Recall that Table 8 presented the degree to which the 85 FAP functions are automated in SPS, less the seven functions outside the scope of this thesis. The remaining 78 functions are now analyzed by the researcher to indicate to what degree each function is an IA innovation candidate by answering the following questions:

- Does SPS automate the function well and need improvement with IA?
- What is the potential benefit for automating the function with IA?

The answer to each question is indicated in Table 10 in the second and third columns. Since these two questions, and those in subsequent sections, are the fundamental and primary questions of this thesis, it is important to now understand the context of each question, as it significantly impacts the outcome of this analysis.

First of all, the questions are designed to determine if each acquisition function is a logical candidate for innovation with IA. The questions are worded so that a positive (e.g., "+") response indicates a favorable candidate. Each function is graded with a "+," if it is a strong, a "0" if it is undetermined or neutral, or a "-" if it is not a candidate for IA innovation.

Table 10. Step 1: Brainstorm Data

FAP Function	Question 1	Question 2	Step 1 Grade
A. Determination of Need			
1. Forecasting Requirements	0	0	0
2. Acquisition Planning	0	0	0
3. Purchase Requests	-	0	-
4. Funding	0	+	+
5. Market Research	+	+	++
B. Analysis of Requirement			
6. Requirements Documents	-	+	0
7. Use of Government Property/Supply Sources	0	+	+
C. Extent of Competition			
9. Required Sources	+	+	++
10. Competition Requirements Unsolicited Proposals	0	0	0
11. Set-Asides	-	0	-
12. 8(a) Procurements	-	0	-
D. Source Selection Planning			
13. Lease vs. Purchase	+	0	+
14. Price Related Factors	0	0	0
15. Non-Price Factors	0	0	0
16. Method of Procurement or Purchasing	0	0	0
E. Solicitation Terms & Conditions			
17. Contract Types— Pricing Arrangements	0	0	0
18. Recurring Requirements	0	+	+
19. Unpriced Contracts	-	-	--
20. Contract Financing	0	-	-
21. Need for Bonds	0	-	-
22. Method of Payment	0	0	0
23. Procurement Planning	0	+	+
F. Solicitation of Offers			
24. Publicizing Proposed Contract Actions	-	+	0
25. Oral Solicitation	+	0	+
26. Solicitation Preparation	-	+	0
27. Pre-Award Inquiries	0	0	0
28. Prebid/Prequote/ Preproposal Conferences	+	-	0
29. Amending/ Canceling Solicitations	-	0	-

(+) = strong IA candidate
(0) = neutral IA candidate
(-) = weak IA candidate

Table 10 (continued)

FAP Function	Question 1	Question 2	Step 1 Grade
H. Proposal Evaluation			
35. Processing Proposals	0	+	+
36. Applying Non-Price Factors	+	+	+ +
37. Price Analysis-Negotiations	0	+	+
38. Pricing Information From Offerors	0	+	+
39. Audits	-	0	-
40. Cost Analysis	+	+	+ +
41. Evaluating Other Offered Terms/Conditions	+	+	+ +
42. Award Without Discussions	-	0	-
43. Communications/Fact-finding	0	+	+
44. Extent of Discussions (Competitive Range)	0	0	0
45. Negotiation Strategy	0	0	0
46. Conducting Discussions/Negotiations	+	+	+ +
I. Contract Award			
47. Debriefing	+	-	0
48. Responsibility	0	0	0
49. Subcontracting Requirements	0	0	0
50. Prepare Awards	-	0	-
51. Issue Awards & Notices	-	0	-
52. Mistakes In Offers	0	0	0
53. Protests	0	0	0
J. Initiation of Work and Modification			
54. Contract Administration Planning	0	0	0
55. Post-Award Orientations	+	-	0
56. Consent to Sub-contracts	+	-	0
57. Subcontracting Requirements	+	-	0
58. Contract Modifications	-	0	-
59. Options	0	0	0
60. Task & Delivery Order Contracting	0	0	0
K. Quality Assurance			
61. Monitoring, Inspection, and Acceptance	0	0	0
62. Delays	0	0	0
63. Stop Work	0	0	0
64. Commercial/Simplified Acquisition Remedies	+	-	0
65. Noncommercial Remedies	+	-	0
66. Documenting Past Performance	0	+	+

Table 10 (continued)

FAP Function	Question 1	Question 2	Step 1 Grade
L. Payment & Accounting			
67. Invoices	0	0	0
68. Assignment of Claims	0	-	-
69. Administering Securities	+	-	0
70. Administering Financing Terms	+	-	0
71. Unallowable Costs	+	0	+
72. Payment of Indirect Costs	+	0	+
73. Limitation of Costs	0	0	0
74. Price and Fee Adjustments	0	0	0
75. Collecting Contractor Debts	0	0	0
76. Accounting & Estimating Systems	+	0	+
78. Defective Pricing	+	0	+
M. Special Terms			
79. Property Administration	0	0	0
80. Intellectual Property	+	-	0
81. Administering Socio-Economic/Misc. Terms	0	-	-
N. Contract Closeout or Termination			
82. Claims	0	0	0
83. Termination	-	0	-
84. Closeout	-	0	-
85. Fraud & Exclusion	0	0	0

Source: Developed by researcher.

Each question is equally weighted and their summation produces a total "grade" for step 1 (listed in the third column of Table 10). The simple summation of these grades range from "- -" (e.g., both questions 1 and 2 are rated "-") to "+ +" (e.g., both questions 1 and 2 are rated "+").

The first question aids in brainstorming by asking how well SPS currently performs the function. The goal of this question is to identify if the existing function needs innovation in the first place. For example, FAP function # 5, Market Research, receives a "+" grade because SPS does not automate and perform Market Research. SPS can manually process and incorporate market research data only if the user specifically

manipulates the data. It is therefore a strong candidate for innovation. On the other hand, FAP # 3, Purchase Requests, receives a "-" grade because SPS does a comprehensive job automating the formation of Purchase Requests. Therefore, it is not a strong candidate. Those functions that fall between these extremes are graded with a "0," like FAP # 2, Acquisition Planning. It is similar to FAP # 5, Market Research, in that it does not automate the function, but it does support Acquisition Planning with features like management reports, tools and attachments. .

The second question in step 1 determines the potential level of benefit available from automating with IA. The goal of this question is to project the future benefit of the innovation and remove those functions that do not present an adequate return on investment from further consideration. If a function, like FAP # 5, Market Research, poses great potential through this type of innovation, then it is graded with a "+." If it does not, like FAP # 19, Unpriced Contracts, it is graded with a "-." Note that this answer is independent from the grading of question 1.

The results presented in Table 10 are distributed as summarized in Table 11. Notice only six of the 78 applicable functions receive an outstanding grade (e.g., "+ +") and well over half are graded as neutral or lower (e.g., "0," "-," "- -"). To facilitate prudent decision making, the 16 negative graded functions are now removed from further analysis. After such removal from the consideration list, total grades can range from "+ +" to "0."

Table 11. Step 1 Summary

Frequency	Grade
6	+ +
15	+
41	0
15	-
1	- -

2. Assess Feasibility/Risk and Select the New Process Design

After brainstorming, it is imperative to apply another filter of questions to determine which functions make the most business sense. In order to assess and select the new process, Davenport suggests that several analyses be performed and that the redesign and current state must be compared in terms of structure, technology, and organization to fully understand the implications of each alternative. [Ref. 9:p. 5] In this section, the 62 remaining brainstorm solutions are now analyzed for feasibility and risk factors by asking the following questions:

- How complex and feasible would it be to innovate a particular function with IA?
- Does it make common sense to innovate with IA relative to risk?

Table 12 includes the total step 1 grade and step 2 questions. The last column lists the total step 2 grade, which reflects a "summation" of the questions above and the grade from step 1. At this stage of the analysis, total grades can range from "+ + +" to "- -" because of the elimination of the unfavorable candidates from step 1 above.

Table 12. Step 2: Assess Feasibility/Risk

FAP Function	Step 1 Total	Step 2 Question 1	2	Total Grade
A. Determination of Need				
1. Forecasting Requirements	0	-	0	-
2. Acquisition Planning	0	-	0	-
4. Funding	+	0	0	+
5. Market Research	++	0	+	+++
B. Analysis of Requirement				
6. Requirements Documents	0	+	+	++
7. Use of Government Property/Supply Sources	+	0	+	++
C. Extent of Competition				
9. Required Sources	++	0	+	+++
10. Competition Requirements Unsolicited Proposals	0	-	-	-
D. Source Selection Planning				
13. Lease vs. Purchase	+	-	-	-
14. Price Related Factors	0	-	+	0
15. Non-Price Factors	0	-	+	0
16. Method of Procurement or Purchasing	0	-	0	-
E. Solicitation Terms & Conditions				
17. Contract Types— Pricing Arrangements	0	-	0	-
18. Recurring Requirements	+	0	+	++
22. Method of Payment	0	-	-	--
23. Procurement Planning	+	0	0	+
F. Solicitation of Offers				
24. Publicizing Proposed Contract Actions	0	+	+	++
25. Oral Solicitation	+	-	-	-
26. Solicitation Preparation	0	0	0	0
27. Pre-Award Inquiries	0	-	+	0
28. Prebid/Prequote/ Preproposal Conferences	0	-	-	--
H. Proposal Evaluation				
35. Processing Proposals	+	0	+	++
36. Applying Non-Price Factors	++	-	0	+
37. Price Analysis-Negotiations	+	-	0	0
38. Pricing Information From Offerors	+	-	0	0
40. Cost Analysis	++	-	-	0
41. Evaluating Other Offered Terms/Conditions	++	-	0	+
43. Communications/Fact-finding	+	0	+	++
44. Extent of Discussions (Competitive Range)	0	-	0	-
45. Negotiation Strategy	0	-	0	-
46. Conducting Discussions/Negotiations	++	-	0	+

Table 12. (continued)

FAP Function	Step 1 Total	Step 2 Question 1	2	Total Grade
I. Contract Award				
47. Debriefing	0	-	-	- -
48. Responsibility	0	0	0	0
49. Subcontracting Requirements	0	0	0	0
52. Mistakes In Offers	0	-	+	0
53. Protests	0	0	-	-
J. Initiation of Work and Modification				
54. Contract Administration Planning	0	0	0	0
55. Post-Award Orientations	0	-	0	-
56. Consent to Sub-contracts	0	0	0	0
57. Subcontracting Requirements	0	0	0	0
59. Options	0	0	0	0
60. Task & Delivery Order Contracting	0	+	0	+
K. Quality Assurance				
61. Monitoring, Inspection, and Acceptance	0	0	0	0
62. Delays	0	0	0	0
63. Stop Work	0	0	0	0
64. Commercial/Simplified Acquisition Remedies	0	-	-	- -
65. Noncommercial Remedies	0	-	-	- -
66. Documenting Past Performance	+	0	+	+ +
L. Payment & Accounting				
67. Invoices	0	0	0	0
69. Administering Securities	0	0	-	-
70. Administering Financing Terms	0	0	-	-
71. Unallowable Costs	+	-	-	-
72. Payment of Indirect Costs	+	-	-	-
73. Limitation of Costs	0	0	0	0
74. Price and Fee Adjustments	0	0	0	0
75. Collecting Contractor Debts	0	0	0	0
76. Accounting & Estimating Systems	+	0	-	0
78. Defective Pricing	+	-	-	-
M. Special Terms				
79. Property Administration	0	+	0	+
80. Intellectual Property	0	-	-	- -
N. Contract Closeout or Termination				
82. Claims	0	+	0	+
85. Fraud & Exclusion	0	-	0	-

Source: Developed by researcher.

The first question asks how hard it would be to innovate a particular acquisition function with IA based on the complexity of the process. The goal of this question is to separate those functions that the current IA technology could reasonably automate from those with lower prospects. If a function is very complex and requires a great deal of human interface, like FAP function # 28, Conferences, then it is graded with a "-." If a function is routine in nature and can be easily automated, like FAP function # 3, Purchase Requests, then it is graded with a "+" because it is a strong IA candidate.

The second question of step 2 asks if the innovation makes common business sense. The goal of the question is to remove any candidate that represents too much risk to the entire process. Risk management is an essential strategic element that cannot be neglected, as it is manifested in many forms, and has potentially severe repercussions if ignored. A good example is FAP # 78, Defective Pricing, which receives a "-" because it is unwise to think that an agent would perform such a sensitive activity. Notice that all payment and accounting functions receive low grades because of the requirement to have an *arm's length* from other acquisition functions.

The results from Table 12 are distributed as shown in Table 13, which are addressed in priority according to their grade strength. The results indicate two clear candidates (scoring "+ + +") for IA. FAP # 5, Market Research, and FAP # 9, Required Sources, are the strongest candidates. Both of these functions should be developed first. Alternatively, there are 23 negatively graded weak candidates (primarily in the acquisition phases of source selection planning, contract award and payment and accounting) that require no further consideration. These two groups mark the extremes of the candidate

range. Then there are the 22 "0" graded functions, most of which are those of the same acquisition phases (e.g., source selection planning, contract award and payment and accounting) of the negative ones just stated. These 22 are likewise removed from consideration due to their questionable candidacy. The remaining 7 "+ +" and 8 "+" functions should be considered further. Therefore, the step 2 analysis produces 17 IA change lever candidates. This represents approximately 20% of the original 85 steps comprising the FAP. To assist in the final selecting of these 17 candidates, the results of Table 12 are summarized in priority sequence in Table 14.

Table 13. Step 2 Summary

Frequency	Grade
0	+ + + +
2	+ + +
7	+ +
8	+
22	0
17	-
6	- -

It is now important to discuss the general comments found in the last column of Table 14 as they summarize the IA candidate results of step 2. The candidates are first separated by overall step 2 grade (e.g., *strongest* "+ + +", *strong* "+ +", and *moderate* "+"). The eight *moderate* IA candidates are further separated into three sub-groups depending on their general grouping of individual grades. The comment section lists a general description of each of the four grades. For example, FAP # 4, Funding, was

Table 14. Phase IV Summary

FAP Function	Step 1		Step 2		Total Grade	Comments
	1	2	1	2		
Strongest Candidates						SPS doesn't automate
5. Market Research	+	+	0	+	+ + +	Strong potential benefit
9. Required Sources	+	+	0	+	+ + +	Moderately feasible Low risk
Strong Candidates						SPS automates
6. Reqmts. Documents	-	+	+	+	+ +	Strong potential benefit
24. Publicizing Actions	-	+	+	+	+ +	Highly feasible Low risk
7. Use of Sources	0	+	0	+	+ +	
18. Recurring Reqmts.	0	+	0	+	+ +	SPS doesn't automate
35. Processing Proposals	0	+	0	+	+ +	Strong potential benefit
43. Comms./Fact-finding	0	+	0	+	+ +	Moderately feasible
66. Past Performance	0	+	0	+	+ +	Low risk
Moderate Candidates						SPS only supports
4. Funding	0	+	0	0	+	Strong potential benefit
23. Procurement Planning	0	+	0	0	+	Moderate feasible Moderate risk
36. Non-Price Factors	+	+	-	0	+	SPS doesn't automate
41. Evaluating Other Offered Terms/Conditions	+	+	-	0	+	Strong potential benefit Not very feasible
46. Conducting Discussions/Negotiations	+	+	-	0	+	Moderate risk
60. Task & Delivery Order	0	0	+	0	+	SPS supports
79. Property Admin.	0	0	+	0	+	Moderate potential benefit
82. Claims	0	0	+	0	+	Highly feasible Moderate risk

Source: Developed by researcher.

scored a "0" (SPS only supports that function), "+" (strong potential benefit), "0" (moderately feasible to accomplish) and "0" (moderate risk) for the four questions, respectively.

The first group of the *strongest* candidates (e.g., "+ + +"), FAP # 5 Market Research and FAP # 9 Required Sources, received identical grades. They received high grades as IA candidates because SPS does not currently automate these functions, there is strong potential benefit and it represents low risk. They did not receive a perfect score of "+ + + +" because the task of programming and developing such IA functions is only moderately feasible. Nonetheless, they are the strongest candidates and are prototyped first in the next section. These candidates share a common, external search and retrieval function that should be replicated in other FAP functions. This proposal is discussed in the following section.

The second group is comprised of seven *strong* candidates (e.g., graded "+ +") divided into two sub-groups. The first sub-group is FAP # 6 Requirements Documents and # 24 Publicizing Actions. Even though SPS already automates these functions, there is strong potential benefit, it is highly feasible to develop and there is low inherent risk. The second group includes FAP # 7 Use of Government Property and Supply Sources, # 18 Recurring Requirements, # 35 Processing Proposals, # 43 Communications and Fact-finding, and # 66 Past Performance. These functions are more complicated in nature to develop and are graded as only *moderately* feasible. However, the overall grade is strong because SPS does not currently automate those functions, there is strong potential benefit and there is low risk.

The third group is comprised of eight *moderate* candidates (e.g., graded "+") divided into three sub-groups. The first sub-group is FAP # 4 Funding and # 23 Procurement Planning. SPS only supports these functions. There is strong potential benefit, it is moderately feasible and there is moderate risk. The second sub-group consists of FAP # 36 Non-Price Factors, # 41 Evaluating Other Offered Terms and Conditions, and # 46 Conducting Discussions and Negotiations. SPS does not automate these functions. There is strong potential benefit, yet it is not very feasible and there is moderate risk. The final sub-group is FAP # 60 Task and Delivery Orders, # 79 Property Administration, and # 82 Claims. SPS only supports these functions and it is highly feasible to develop. However, there is only moderate potential benefit and there is moderate risk.

With nine more likely candidates, these last eight *moderate* candidates are considered to be undesirable for innovation because they lack enough potential. Therefore, the researcher now removes them from further analysis. The remaining nine candidates possess the essential positive traits to innovate SPS. The researcher now proposes two SPS redesigns from first the *strongest* and then the *strong* candidate group.

3. Prototype the New Process

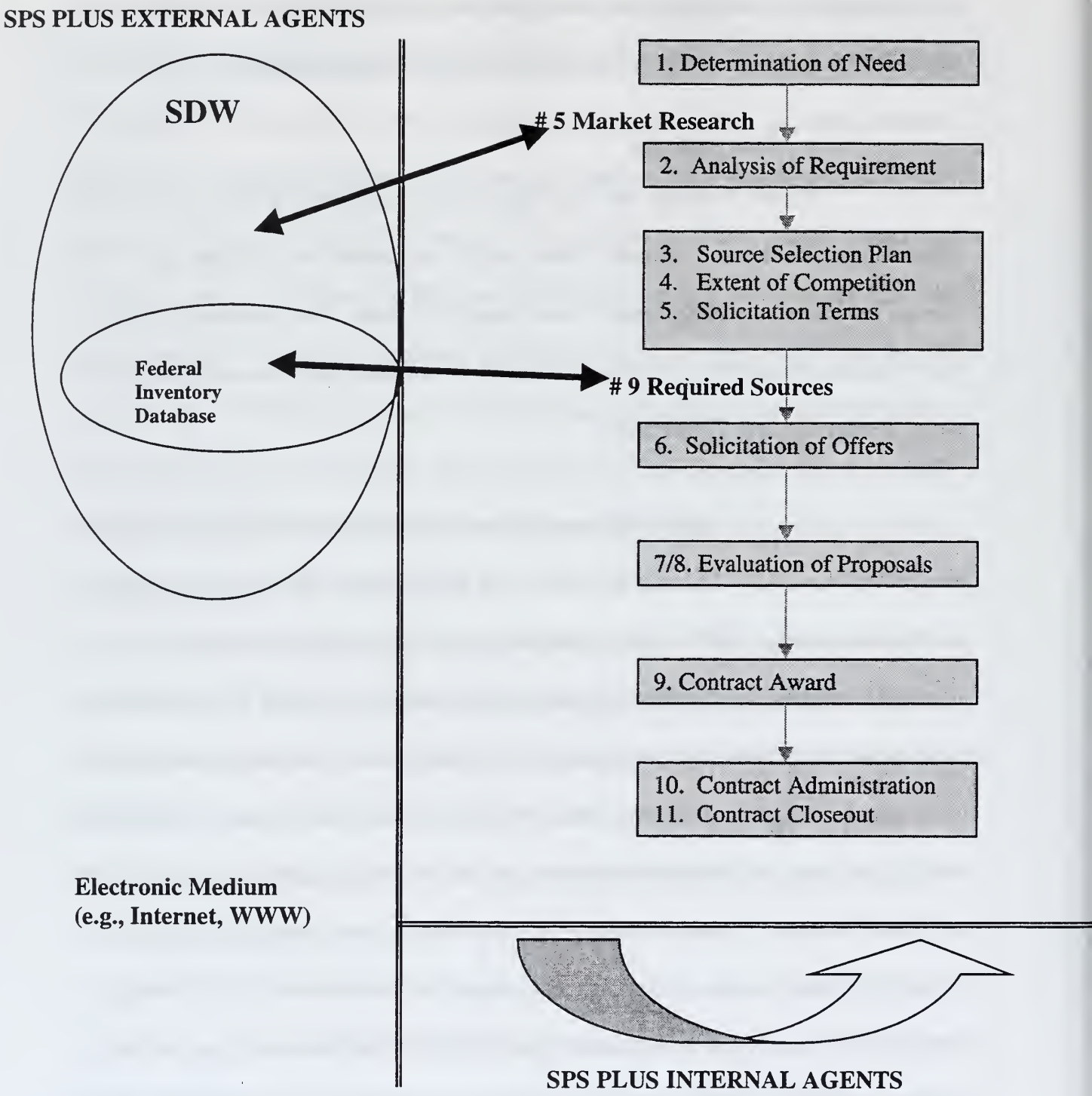
The final step of this analysis is to propose a prototype design of the new process. The first of two proposed SPS redesigns incorporates the two strongest candidates for IA: 1) Market Research, and 2) Required Sources. Figure 6 shows the redesign proposal implementing these two strongest IA candidates. For reference the baseline process is

presented from Figure 5, Chapter II, and summarized as shown in the shaded area to the right. The IA change levers are in **bold** format to highlight the innovation.

a. First Redesign

Figure 6 details the first stage of IA innovation for SPS. For a "big picture," refer to Figure 3, Process Vision, and its discussion from Chapter III. This process vision describes the proposed virtual acquisition arena. The following prototypes depict specific process designs within that vision. Recall that agents are employed in two ways: 1) externally and 2) internally.

1. Market Research External "SPS Plus." The first function to incorporate IA is FAP # 5 Market Research. First of all, multiple agents can be employed to function outside of SPS (more specifically, the PD^2 software application and its supporting architecture) via electronic means on the Internet. Agents can be tasked to perform the two specific market research tasks, market investigation and exchanges prior to soliciting. [Ref. 11:p. 5-5] According to the FAP, market investigation includes 1) identify the types of market information needed for the acquisition, 2) review of acquisition histories, 3) determine scope and extent of additional research, 4) identify and collect data from catalogs, periodicals, and interactive on-line sources, and 5) estimate proper price or value prior to soliciting. [Ref. 11:p. 5-5] Market research agents, (e.g., specific artificial intelligent agents) are tasked to perform a specific function. For example, suppose we require a computer monitor.



Source: Developed by researcher.

Figure 6. First Stage "SPS Plus" Redesign

One agent is sent out to identify prices in a specific electronic catalog, like GSA Advantage. Another agent is sent to do the same in another catalog, like a national commercial franchise. These agents are tasked to retrieve the data and report back to the "SPS Plus" user on a periodic and specified basis, tailored to the user's needs and desires.

Similar agents are tasked to continually reside on catalogs and report to the user when that item is added or the price is modified. Another agent filters and periodically reports all of the new Commerce Business Daily (CBD) announcements for all related computer monitor acquisition actions. A more advanced performative agent goes out to our historical customers, communicates our requirement and then informs us if that source is a potential supplier.

Figure 6 refers to the Shared Data Warehouse (SDW), which is the generic term used to describe electronic sites where accessible data resides and where agents can be deployed. The SDW includes sites that host commercial specifications and standards, laws, past performance, patents, small businesses, Federal sources, Government contract files, vendor contract files, Consumer Reports, telephone directories, the Thomas Registry, trade journals, news media, and commodity indices. The greatest outcome of these features lies not only in the fact that these functions are automated, but that more information is shared and used. Instantaneous and continual access to this type of data collection and manipulation should promote more competition and better prices. As mentioned earlier, this external IA search, retrieval, filter and

perform function should be replicated and incorporated into other strong candidates. The researcher refers to this process as “External SPS Plus."

The arrows in Figure 6 represent the use of electronic external SPS Plus to a specific remote Internet site. For example, the Market Research arrow goes to the SDW to manipulate a wide array of acquisition specific data on the Internet, like Government-wide historical contract files. Notice that it also passes through the generic Internet electronic media. This implies that Market Research agents also interact with other non-acquisition specific sources, like common search engines. For Required Sources, notice that the arrow immediately enters the Federal Inventory Database. Agents are only tasked to perform functions within this site and do not travel to other sites.

Agents are similarly tasked to search, filter, and retrieve data, and to perform advanced functions outside of SPS in the second aspect of market research, which is "exchanges prior to solicitation.” Agents automate the majority of routine functions like sending out a request for information (RFI), notices, establishing industry panels and conducting basic exchanges. This process is much simpler in nature, yet it represents an important aspect of market research.

2. Required Sources External "SPS Plus." The second acquisition function to innovate with IA in the first redesign prototype is FAP # 9, Required Sources, which entails the checking of required sources of supply to determine availability. Both of these functions occur in the acquisition planning phase of the FAP, but Market

Research is from Determination of Need, Step 1, and Required Sources is from Analysis of Requirement, Step 2. Many aspects of the Required Sources function are very similar to that of Market Research except that it is more defined and regulated to specific sources of supply. Agents can deploy to Required Sources databases like Agency inventories, Excess Personal Property, Federal Prison Industries, products available from the Committee for Purchase from People Who are Blind or Severely Disabled, stock programs (e.g., GSA, DLA, Veterans Affairs, Military Inventory Control), and mandatory Federal Supply Schedules.

3. Market Research Internal "SPS Plus." The second aspect of the first redesign is the internal innovation of PD^2, which the researcher refers to as the Internal SPS Plus Agent function. The Internal SPS Plus Agent portion of Figure 6 depicts the specific agent functions that are performed within the local SPS program. This represents the employment of IA as stated below.

Referring back to Table 8, Market Research is graded a "0" because SPS only supports building a vendor database. SPS automates some of the Market Research functions and provides a checklist which serve as reminders to check alternative sources. If the user did not input and continually update the data and use the Solicitation Mailing List functions, then that function would be worthless. It is a closed system. That is why Table 14 graded Market Research with a "+," because SPS is in great need of innovation in that function.

One agent could collect all the in-house data regarding historic and current contracts, similar to the external agents stated previously. Another agent could collect the external "SPS Plus" data and format it into comprehensive reports, estimate price and total acquisition cost, publicize the method of exchanges, send out exchanges of information, issue a Request For Information, request feedback, draft pre-solicitation notices, and conduct pre-solicitation conferences. By automatically performing these functions, the user could save a great deal of time and be able to perform more intuitive, value-added tasks.

4. Required Sources Internal "SPS Plus." Internal IA can also be employed to Required Sources, which is graded in Table 8 with a "0" because SPS automates and supports it. Table 14 grades it with a "+" because it can be greatly innovated. Agents could prepare, purge, rotate and update source lists, like a qualified bidder list. Another agent could search for an existing contract or agreement and actually place an order against it. These IA functions are not easy to employ and require user-specific tailoring to avoid a boilerplate, dysfunctional product. It is essential to ensure that the proper process is automated. Otherwise, the innovation will not be successful.

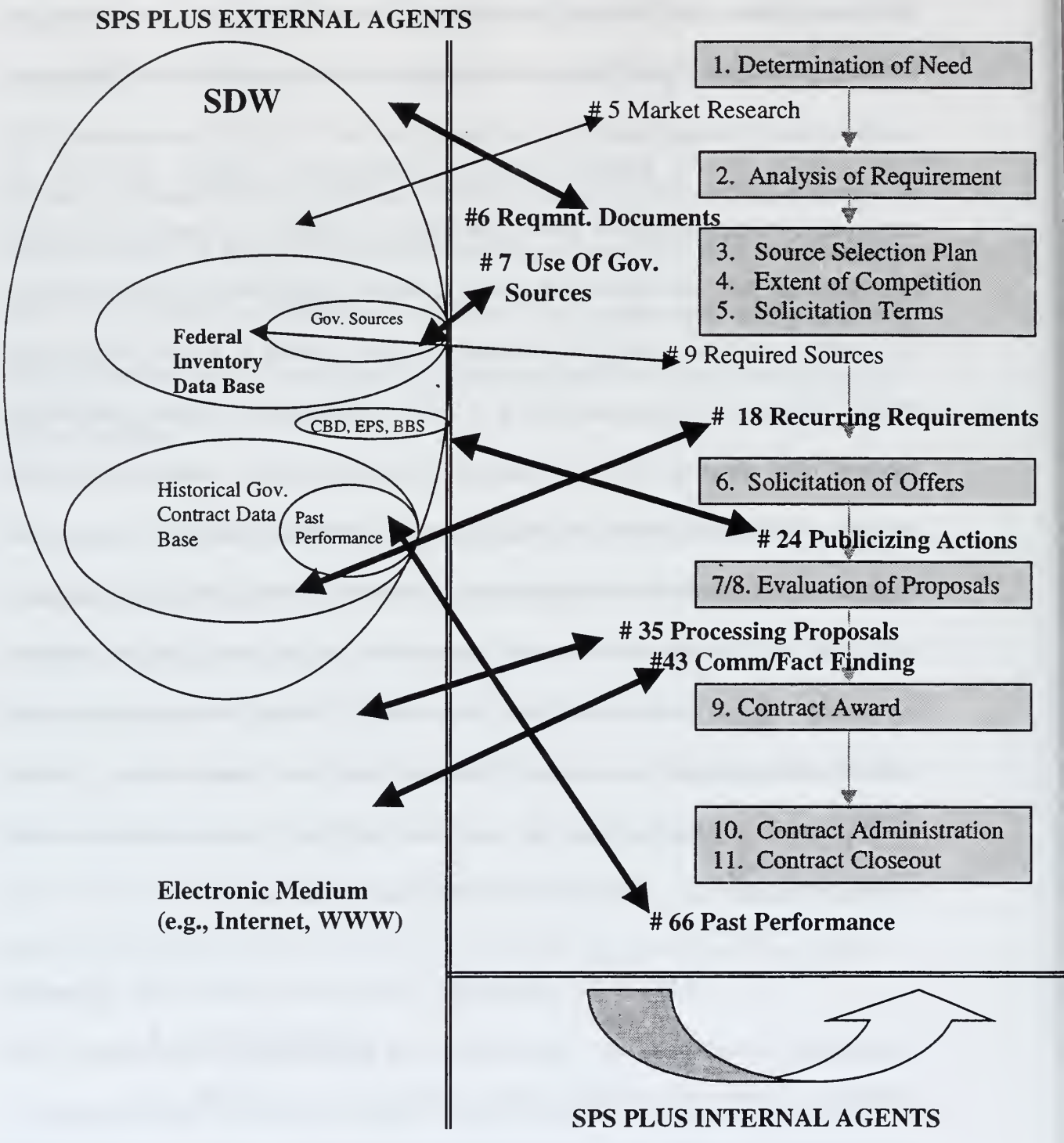
b. Second Redesign

In addition to the previous two candidates, the second and more challenging SPS redesign incorporates the next seven *strong* candidates: 1) Requirements Documents, 2) Use of Government Property/Sources, 3) Recurring Requirements, 4)

Publicizing Actions, 5) Processing Proposals, 6) Communications and Fact-finding, and 7) Past Performance. Figure 7 depicts this redesign with an expanded view of Figure 6.

1. External Aspect of "SPS Plus." Multiple agents can be employed to function outside of SPS via the Internet similar to that expressed in the first redesign. In fact, the second redesign can benefit significantly from the prototype developed in the first. An earlier function is often repeated in a more focused and detailed fashion. For example, FAP # 7 (Use of Government Property and Supply Sources) is common to FAP # 9 (Required Sources), which is detailed in the first redesign. FAP # 7 searches for specific commodities from designated sources for Government Furnished Property applications. FAP # 9 is less limited and searches a wider array of Government sources for all types of acquisitions. Detailed software engineering research could be conducted to determine if an agent could perform both tasks and thus streamline the process. This action could save a step and time, but this would probably be nominal since the majority of all the IA actions will already be occurring simultaneously. Why combine them when you don't have to?

FAP # 24 (Publicizing Actions) and FAP # 18 (Recurring Requirements) are also similar to the actions in the first redesign by the external "SPS Plus" agents as described in Market Research. Agents can execute announcements to multiple electronic postings, as well as to both the on-line and paper Commerce Business



Source: Developed by researcher.

Figure 7. Second Stage "SPS Plus" Redesign

Daily (CBD) publications. Agents are also tasked to go to shared databases on the Internet for all historical Government requirements. The cost savings presented here are enormous as the use of existing contracts and agreements can be maximized and the rework of common prior acquisition documents can be easily replicated. The more data shared, the more benefits. For FAP # 66, agents can be tasked to go to past performance sites. Those steps that share these common external attributes are grouped into a generalized function called the "SDW agent network."

The SDW is segmented in Figure 7 to show that particular destination for the specified IA function as described in Figure 6. For example, the Past Performance data base segment represents the External SPS Plus functions with that specific agent. Notice that the Recurring Requirements function also specifically interacts within the Past Performance database as part of the larger Federal Historical database.

Agents can also be tasked to perform other specific tasks, like sending requirement documents to specific sites (e.g., via an agent over the Internet and not EDI), initiating communication and conducting fact-finding. These are more unique and tailored to those functions. Special effort must be employed to ensure these are accomplished correctly.

2. Internal Aspect of "SPS Plus." The second aspect of the second redesign is the internal innovation of PD^2. Since SPS already automates

Requirement Documents and Publicizing Actions, IA innovation is probably not required. Why innovate it if it does not need it, especially in an early prototype? Internal agents can be used to gather and present Use of Sources, Recurring Requirements, Communication and Fact-Finding, and Past Performance data in meaning managerial formats. Internal agents also facilitate the Proposal Processing function. Agents take all proposals and present data into logical groupings to allow the user to render better decisions. Agents also automatically communicate back to vendors based on the user's actions, like award, non-award or errors.

Judging the analysis from these two redesigns, it is clear that the internal agents will require significant software engineering to ensure they are employed properly. The external agents are simpler and share many common elements. These generalizations are important for designing the new process and indicate potential applications in other disciplines. The question then becomes, can this acquisition redesign serve as a model for other IA innovations for related fields like logistics and finance?

C. SUMMARY

In this chapter the Federal Acquisition Process (FAP), specifically in the form of the Standard Procurement System (SPS), is analyzed for possible change levers. Technological change levers that incorporate intelligent agents (IA) are explored for each acquisition function. Following Davenport's methodology, a new process design prototype is described.

The researcher first brainstorms for possible IA candidates using each function in the FAP. Then the field is narrowed down to more likely candidates by asking questions regarding the existing performance of SPS and the potential benefit of automating with IA. Asking questions regarding the feasibility and risk of using IA further reduces the remaining group of IA candidates. The researcher then completes that last step of Davenport's model by discussing and diagramming two redesign prototypes using the top seven IA candidates.

The results of this analysis present nine clear IA candidates. The two primary candidates are Market Research and Required Sources. The majority of these IA functions comprise external manipulation of acquisition data. The other seven candidates present similar external applications as well as other opportunities to innovate internal functions within SPS.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The primary objective of this research paper is to propose intelligent agent (IA) technologies, using Davenport's process innovation model, for the innovation of the Standard Procurement System (SPS). The research is deemed necessary for several reasons. First, SPS has yet to show the intended cycle time and cost savings associated with the system's greater standardization and automation. In fact, SPS has been plagued with delays, cost overruns and various other problems. But some of these problems are reasonable to expect from this type of a radical and comprehensive improvement, especially in the information technology (IT) arena. Second, SPS does not leverage advanced IT for innovation. DoD has not purchased the Internet version of SPS; it still relies on electronic data interchange (EDI) for external document transmission. There is significant advanced IT being used in the commercial marketplace that SPS could capitalize on for innovation. Finally, this research is also required because SPS did not undergo a process innovation review prior to its acquisition. Simply inserting new technology into an existing process without first redesigning it is equivalent to "paving the cowpaths." [Ref 34] These issues have created much apprehension and reluctance in the complete implementation of SPS.

Rapid advancements in IT have allowed pursuing greater levels of improvement in many critical processes, and one such IT development is the use of intelligent agents (IA). Government acquisition is an ideal candidate for using IA for innovation because of

its high cost and time-intensive nature. IA shows great potential for innovating the majority of the more routine and redundant acquisition functions. By accomplishing this automation, the user can be freed up to perform more value-added tasks (e.g., managing relationships, analyzing data, approving final documents). In addition, through the ability to share more acquisition data, there will be less rework and under-utilization of existing resources.

The primary research question of this thesis is to propose how IA can be used to innovate and enhance the performance of SPS. An analysis of the 85 Federal Acquisition Process (FAP) steps, as they occur in SPS, was used according to Davenport's systematic innovation model. Each step was graded as to its candidacy as an IA change lever. Extensive literature reviews and interviews provide background information for the standard procurement process, FAP, SPS, IA and process reengineering.

The secondary research questions present a framework for building 1) a comparison and 2) a filtering process for selecting the best IA candidates. First, the critical functions of the Federal procurement process were detailed using the FAP as a baseline. The critical functions of SPS were then compared side-by-side to those of the FAP. This data presentation listed how SPS performs these functions (e.g., using manual or automated IT means). Second, these functions were then individually analyzed and graded according to their IA candidacy. This grading included defining 1) the potential benefit, 2) the capability of SPS, 3) the feasibility of creating the IA and 4) the associated risk. This filtering process removed those candidates with total grades that, in general, represented a poor and risky investment. Through this analysis, nine of the strongest IA

candidates were separated from the other lower potential prospects. Finally, the researcher proposed a process redesign prototype and described what specific IA technologies could be utilized to innovate SPS. The prototypes of the corresponding external and internal "SPS Plus" agents provide for a significant reengineering of not only the Federal procurement process, but other general applications as well (e.g., budget management, transportation logistics, inventory control). Based on these findings, a set of conclusions and recommendations now follows.

B. CONCLUSIONS

The researcher concludes that there are nine distinct candidates for innovating SPS with IA, as segregated into two groups. The first group includes the two *strongest* candidates, Market Research and Required Sources. Market Research entails multiple, labor-intensive tasks of gathering data (primarily from an external source) about the requirement. In "SPS Plus" these agents can perform the work of hundreds of acquisition personnel by continually tapping and processing the data resources found on the Internet. Market Research is a broad and complex application that has many common functions in the FAP. The second *strongest* candidate, Required Sources, is one such function. Certain acquisitions must be purchased from directed sources of supply. Agents can perform this specific search, retrieval and action function, which is similar but only more defined than Market Research. Both functions received high grades (scored "+ + +") as IA candidates because there is strong potential benefit and low risk to innovate SPS.

As a group of candidates, there is great potential benefit to be reaped from enabling agents to perform routine functions and to share vital logistics data. These candidates share a common, external search and retrieval function that can be replicated in other FAP functions (e.g., Use of Government Property/Sources, Recurring Requirements, Past Performance). First, the internal "SPS Plus" station uses IA to conduct the majority of the redundant, clerical and programmable acquisition functions. These agents perform tasks within the acquisition shop's network of computers. Second, there are those external agents who not only function outside the local network, like on the Internet, but also function within the greater "SPS Plus" network connected throughout DoD.

The second group was comprised of seven *strong* candidates (scored "+ +"), which were divided into two sub-groups based on common individual grades to each question. The first sub-group was Requirements Documents and Publicizing Actions. Requirements Documents pertains to the formation, delivery and retrieval of responses to purchase requests. Both internal and external agents perform these tasks. Publicizing Actions deals with sending public solicitation announcements to potential vendors, using such formats as the Commerce Business Daily (CBD) on-line version (CBD Net) and other electronic business opportunity sites. Even though SPS already automates a majority of these functions (e.g., contract formation, CBD transactions), there is strong potential benefit, high feasibility to develop and low inherent risk for innovating with IA (e.g., sending agents to specified vendors to search for products, determine the best price, and make a purchase).

The second sub-group includes Use of Government Property/Supply Sources, Recurring Requirements, Processing Proposals, Communications/Fact-finding, and Past Performance. These functions are more complicated in nature to develop and were graded as only moderately feasible. They also entail the use of internal and external "SPS Plus" agents. Internal agents assist in processing this data, organizing it into a usable format and forming relevant acquisition documents. External agents perform the majority of routine work continually on the Internet to specific sites. Use of Government Property/Supply Sources, Recurring Requirements and Past Performance all share the basic external agent format as described earlier under Market Research and Require Sources. The Processing Proposals and Communications/Fact-finding functions were unique in that the first pertains to analyzing vendor input and the second pertains to the specific send and return of information to vendors. However, their overall grade is *strong* because SPS does not currently automate those functions, and there is strong potential benefit and low risk.

This thesis also presents other generalized conclusions. First of all, IA can be applied to other non-acquisition logistics related functions, like transportation, inventory, finance and personnel. This opens a broader field of IA research and development (R&D) opportunities. Therefore, one question that should be addressed is who will sponsor such R&D. Will the SPS program office pursue such a project?

Programming and developing such IA functions is feasible at present. Small-scale agent shopping mall prototypes currently exist using IA. [Ref. 38] Agents are tasked to search vendors that are located in an "intelligent shopping mall." The agents are given a

specific commodity and go searching for that commodity at all the shops. After their search is complete, the agent selects the lowest price and initiates a purchase transaction with the vendor. The agent then returns to its origin with the appropriate information (e.g., a purchase order or invoice with the item's description, delivery schedule and payment detail).

This simplified yet ingenious model of the acquisition process presents a great foundation on which to build. Agents can be tasked to perform more specific and detailed tasks. One agent could work specifically within the SPS-Plus application to ensure compliance with certain restrictions. For example, in the above virtual shopping mall, a rule exists that makes the shopping agent literally stand inverted while in a particular store. This represents the ability to program an agent to perform a specific task in relation to a rule or regulation, like conforming to a Set-Aside or a particular clause. In addition, external agents can navigate the information super highway to capitalize on the abundant amount of data on the Internet. These agents can simultaneously work around the clock performing many functions (e.g., searching for potential supply sources on Government databases, gathering and sorting prices of sources found on published electronic catalogs, communicating with vendors to set up and initiate transactions, conducting past performing analysis).

Although this IA capability exists, there are issues that are addressed in the recommendation and further research sections. These issues include the need for extensive training, the necessity to control cost, a better understanding of specific Internet challenges (e.g., security, compatibility), the role of risk management, the development of

a detailed migration plan and a short-term improvement plan. These issues are discussed in more detail in the following final sections.

C. RECOMMENDATIONS

Based on these conclusions, it is recommended that various IA R&D projects be accomplished in the IA and acquisition arena. First of all, this thesis should be followed with a joint thesis undertaken by a team of acquisition and software engineering students that builds upon these findings. This can be accomplished in several ways. First of all, the joint team can follow the primary finding of this thesis (e.g., innovate SPS in the highest rated candidates) and develop a new model from scratch. One other option is to develop a new model that builds upon existing models (e.g., the intelligent shopping mall).

Regardless of what approach is taken, whether the IA application is ready or not, the researcher recommends that the top IA candidates be developed first. The researcher believes that Required Sources would be the best primary candidate because it is relatively more simple and provides a framework for others to follow. Then other candidates should be implemented individually and in the priority of their strengths. Only after these have been implemented should the other lower graded candidates (scored "+") be implemented, as some of them may prove to be a logical candidate in the future. The scores assigned to the various FAP functions therefore outline a migration plan for addressing SPS innovation with IA. In addition, the external aspects of the candidates need to developed first and will provide greater benefits by allowing the computer to

automatically perform labor intensive tasks via the Internet. Other functions (e.g., Use of Government Property/Supply Sources, Recurring Requirements and Past Performance) can then be more easily replicated because they all share the basic in formation as described earlier under Market Research and Require Sources.

In more general terms, continued innovation with advanced IT should be pursued. This thesis identifies and discusses possible redesigns of SPS with IA as the innovating IT change lever. There are and will be other potential IT enablers besides IA that should be examined, like wireless telecommunications and voice recognition software. In addition, as IA becomes mature, a complete redesign of the FAP should be reconsidered to include advanced IT. This thesis proposed individual functions to innovate. Many of the common external agent functions (e.g., Market Research, Use of Government Property/Supply Sources, Recurring Requirements and Use of Required Sources) may be more efficient to operate in parallel rather than in series. Finally, there are several other potential disciplines that could benefit from similar IA innovation, like financial management, inventory control and other logistic areas. For example, a "budget agent" could monitor critical funding levels, or an "inventory agent" could manage remote inventories.

There are several other important issues that cannot be ignored. Training is a serious consideration and major cost driver. Additional training programs in electronic commerce in general, and specifically IA, should be developed to address the anticipated cultural resistance. Cost management is also key. Cost overruns have jeopardized the future of SPS and must be properly managed, especially because the requisite IA software

engineering may prove to be expensive. It is recommended that its cost be analyzed to ensure it is a worthwhile investment (e.g., investment and life cycle cost, relative comparison of cost to alternatives, potential benefits). There are also specific Internet issues that must be dealt with before progressing (e.g., security and access issues with firewalls, compatibility and future use of EDI, which standard language to use, like extended markup language, XML). There needs to be a strong focus on how to use the Internet as a change lever.

Risk management should also be employed. Risks need to be carefully identified and a program should be developed to manage them. One does not want a system that just paves another cowpath and produces useless boilerplate applications. One should also investigate the potential problems and adverse reactions of integrating "SPS Plus" with other systems, particularly financial management systems. A migration plan should also be designed in detail to mitigate risk taken to implement the redesign prototype. Care must be taken in choosing test sites to ensure that the initiative is the greatest potential for success. An incremental, phased approach to implementation may result in the most efficient and least disruptive migration strategy. Finally, short-term improvements should be developed to deal with SPS' existing problems. Even though there has been significant progress in the IA R&D field, the more advanced prototypes may take years to develop and implement. This could include enhanced training, feedback and performance. Based on these recommendations, areas of further research are proposed.

D. AREAS OF FURTHER RESEARCH

1. Follow-on Theses

This research should be continued as a joint thesis, undertaken by an acquisition and software researcher team. Further research could be divided first into the two *strongest* candidates. Required Sources would be the best primary candidate because it is relatively more simple and provides a framework for others to follow. Then other candidates should be implemented individually and in the priority of their strengths. Another way to divide the research is to select common function formats. For example, many of the common external "SPS Plus" agent functions (e.g., Market Research, Recurring Requirements and Use of Required Sources) are similar and can be produced after the first is done more easily. The external aspect of the candidates should be developed first and will provide greater benefits by allowing the computer to automatically perform labor intensive tasks via the Internet. This type of study may entail detailed IA R&D that includes designing agent software, simulation and testing models. The team should decide if they will start from scratch or build upon existing IA models (e.g., the intelligent mall).

2. Continued SPS Innovation

Further study may be required to identify and discuss other possible redesigns of SPS. As IA becomes mature, a complete redesign of the FAP should be reconsidered to include advanced IT. For example, many of the common external agent functions (e.g., Market Research, Recurring Requirements and Use of Required Sources) may be more efficient to operate in parallel rather than in series.

3. Other IT Advancements

Further study may be required to identify and discuss other possible redesigns of SPS using other advanced IT. There are other potential IT enablers besides IA that should be examined, like wireless telecommunications and voice recognition software. It is essential to benchmark industries' cutting edge technology in order to become a world class acquisition force.

4. Training

Further study is required to develop a comprehensive training program. The procurement community will require additional training programs in electronic commerce in general, and specifically IA. SPS is already complex and requires substantial training. IA is not well understood and will therefore require even more training effort. The majority of software users only take advantage of a fraction of a program's functionality. It is useless to redesign SPS with IA and have no one use it because there was poor training.

5. Use of the Internet

Further study may be required to focus on how to use the Internet as a change lever. There are many Internet issues that need to be addressed in detail. Security matters are important because of the easy access to substantial amounts of government information on the Internet. Firewalls, pass codes, encryption and user access rights (e.g., read only verse read-write) issues should be investigated. Language uniformity will also be an issue as the Internet continues to evolve. Better languages and applications are

continually developed, like XML. The SPS redesign should be kept current to avoid obtaining a sub-par and obsolete system.

6. Risk Management

Further study is required to investigate the potential problems and adverse reactions of integrating "SPS Plus" with other systems. Financial management systems should be kept separate at an arm's length from acquisition shops. Databases must be kept up to date or the processing of the data will be erroneous. As mentioned above, several Internet unique issues present significant risk that should be researched.

7. Migration Plan

Further research is required to develop a detailed migration strategy to implement the redesign prototypes. Once the model is developed and tested, care must be taken in choosing test sites. Schedules must be manipulated to ensure that the initiative is the greatest potential for success. An incremental, phased approach to implementation may result in the most efficient and least disruptive migrations. A significant part of this plan should be to determine who would sponsor and lead the research.

8. Cost Management

Further research is required to develop a cost management program. High cost overruns are already commonplace and need to be mitigated. The high cost of software engineering will no doubt create funding challenges. In order to overcome this challenge, a creative and up-front funding plan should be developed. One should conduct a detailed cost-benefit analysis to determine a clearer picture of the anticipated costs and long-term savings.

9. Short-term Improvements

Further research is required to develop short-term improvements to the existing SPS problems. Since detailed prototypes like "SPS Plus" are at least a year off, it is imperative to correct some of SPS' bigger problems. This should include better feedback loops between customers, enhanced training (e.g., video teleconferencing, Internet interaction, more on-site options) and quicker software debugging.

10. Other Generalized Applications

Finally, there are several other potential disciplines that could benefit from similar IA innovation research. One should investigate how to employ agents to monitor multiple budgets, inventory control systems, transportation routing and personnel assignments. In fact, this list could include practically all other logistic and DoD areas.

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APPENDIX A: LIST OF TERMS AND ACRONYMS

The following list of terms and acronyms aid the reader with the abundance of acquisition and information technology jargon used throughout this thesis: [Ref. 16, Ref. 20, Ref. 36, Ref. 40]

Agent: The use of an employed advanced electronic decision making applications to perform routine programmed operations in expert systems.

ANSI X12: The designation assigned by the American National Standards Institute (ANSI) for the structure, format, and content of electronic business transactions conducted through Electronic Data Interchange (EDI). ANSI is the coordinator and clearinghouse for national standards in the United States.

Artificial Intelligence (AI): The use of advanced electronic decision making applications to perform routine programmed operations in expert systems. When employed, are also called Intelligent Agents.

Authentication: A security measure that verifies that an electronic message was not tampered with or altered during transit.

Automated Information System (AIS): A combination of computer hardware and software, data, or telecommunications, that performs functions such as collecting, processing, transmitting, and displaying information. Excluded are computer resources, both hardware and software, that are physically part of, dedicated to, or essential in real time to the mission performance of weapon systems.

Buy-American Act: Provides that the U.S. government generally give preference to domestic end products. (Title 10 U.S.C.41 A-D). This preference is accorded during the price evaluation process by applying punitive evaluation factors to most foreign products. Subsequently modified (relaxed) by Culver-Nunn Amendment (1977) and other 1979 trade agreements for dealing with North Atlantic Treaty Organization (NATO) allies.

Central Contractor Registration (CCR): The means by which a contractor can conduct electronic commerce with the Federal Government. The contractor must provide registration information via the CCR.

Commercial Item: A commercial item is any item, other than real property, that is of a type customarily used for non-governmental purposes and that has been sold, leased, or licensed to the general public; or has been offered for sale, lease, or license to the general public; or any item evolved through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a government solicitation.

Competition: An acquisition strategy whereby more than one contractor is sought to bid on a service or function; the winner is selected on the basis of criteria established by the activity for whom the work is to be performed. The law and DoD policy require maximum competition throughout the acquisition life cycle.

Contract Data Cover Sheet: CDCS

Contract Data Requirements List (CDRL) A DD Form 1423 list of contract data requirements that are authorized for a specific acquisition and made a part of the contract.

Contract Line Item Number: CLIN

Decision Support System: DSS

Defense Acquisition Deskbook: An automated reference tool sponsored by the Office of the Under Secretary of Defense (Acquisition and Technology) (OUSD(A&T)) to assist program offices in implementing DoDD 5000.1 and DoD 5000.2-R. It consists of a World Wide Web (WWW) home page with a bulletin board, an information structure of discretionary information, and a reference library of statutory and regulatory guidance.

Electronic Commerce (EC): The paperless exchange of business information, using Electronic Data Interchange (EDI), electronic mail, electronic bulletin boards, electronic funds transfer and other similar technologies.

Electronic Commerce Processing Node (ECPN): A collection of hardware and software systems which provides communications connectivity between Value Added Networks (VANs) and the Government Gateways to support the exchange of EDI transactions between Government procurement agencies and private sector Trading Partners. There are currently two ECPNs, located in Columbus, Ohio and Ogden, Utah.

Electronic Commerce (EC)/ Electronic Data Interchange (EDI) Infrastructure: A system of interconnected communications and computer systems supporting the exchange of EDI transactions between Government activities and their trading partners. The use of a single infrastructure allows both Government activities and the Value Added Networks to connect to the two Network Entry Points (NEPs) in an economical and efficient manner. The infrastructure also supports the concept of a "single face to industry" which

allows Government trading partners to register with the Government once through CCR, and be able to do business with any Government procurement activity on the system.

Electronic Document Access (EDA): An on-line file cabinet for the storage and retrieval of contracts and modifications used by multiple activities. EDA is dramatically reducing the need to manually print and distribute documents.

Electronic Data Interchange (EDI): EDI, a major part of EC, is the computer-to-computer exchange of business data in a standardized format.

Electronic Data Interchange (EDI) Standards: Rules by which business data are translated into a computer-readable format for electronic transmission to a Trading Partner's computer for processing. Also known as ANSI ASC X12 standards in the U.S.

Electronic Funds Transfer (EFT): The exchange of payment and remittance information electronically.

Electronic or Digital Signature: A code or symbol that is the electronic equivalent of a written signature.

Encryption: The transformation of confidential plain text into a cipher text in order to protect it.

Enterprise Wide Document/Data Management (EDM): An automated business practice that allows access to all required information. It supports the capture of paper or fax documents not readily available electronically and not highly structured.

Expert System: A computer system that incorporates AI in making routine programmed decisions.

Extended Markup Language: XML

Federal Acquisition Computer Network (FACNET) Architecture: The Government-wide Electronic Commerce/Electronic Data Interchange (EC/EDI) operational capability for the acquisition of supplies and services. It provides for electronic data interchange of acquisition information between the Government and the private sector, employs nationally and internationally recognized data formats, and provides universal user access.

Federal Acquisition Regulation (FAR): The regulation for use by federal executive agencies for acquisition of supplies and services with appropriated funds. The FAR is supplemented by the Military Departments and by DoD. The DoD supplement is called the DFARS (Defense FAR Supplement).

Federal Stock Class Number: Code developed by the Defense Logistics Agency for use in DoD 's supply management program.

Full and Open Competition: All responsible sources are eligible to compete. The standard for competition in contracting. Required by the Competition in Contracting Act (1984).

Gateway: Consists of both hardware and software that provide EDI translation services, archiving, security, and environment management for converting non-ANSI X12 business application systems data into ANSI X12 format to Government procurement activities. Gateways typically support numerous Government business systems that are located locally or are dispersed geographically.

Hyper Text Markup Language (HTML): An SGML-based language used to create Internet World Wide Web Pages that incorporate hypertext links, text, graphics, sound and video.

Intelligent Agent (IA): The use of advanced electronic decision making applications to perform routine programmed operations in expert systems.

Indefinite Quantity Contract: Provides for furnishing an indefinite quantity, within stated limits, of specific supplies or services, during a specified contract period, with deliveries to be scheduled by the timely placement of orders upon the contractor by activities designated either specifically or by class.

Interface: A recognized and definable crossover point between two systems.

Local Area Network: LAN

Large Purchase: A purchase for more than $100,000.

Major System: A combination of elements that shall function together to produce the capabilities required to fulfill a mission need, including hardware, equipment, software, or any combination thereof, but excluding construction or other improvements to real property.

Market Survey: Attempts to ascertain whether other qualified sources capable of satisfying the government's requirement exist. This testing of the marketplace may range from written or telephone contacts with knowledgeable federal and nonfederal experts regarding similar or duplicate requirements, and the results of any market test recently undertaken, to the more for all sources-sought announcements in pertinent publications

(e.g., technical/scientific journals, or the Commerce Business Daily), or solicitations for information or planning purposes.

Micro-purchase: An acquisition of supplies or services (except construction), the aggregate amount of which does not exceed $2,500, except that in the case of construction, the limit is $2,000.

Negotiation: Contracting through the use of either competitive or other-than-competitive proposals and discussions. Any contract awarded without using sealed bidding procedures is a negotiated contract.

Modem: A hardware device that converts digital (computer) data into audio (analog) tones for transmission over a telephone network. The process is reversed when receiving data.

Network Entry Point (NEP): A collection of hardware and software systems which provides communications connectivity between Value Added Networks (VANs) and the Government Gateways to support the exchange of EDI transactions between Government procurement activities and private sector Trading Partners. There are currently two NEPs located in Columbus, Ohio and Ogden, Utah.

Purchase Order (PO): A contractual procurement document used primarily to procure supplies and nonpersonal services when the aggregate amount involved in any one transaction is relatively small (e.g., not exceeding $25,000).

Purchase Request: PR

Real-Time EDI: EDI in which transaction sets are sent and received on-line and entire transactions can be completed in a single session. Presently, most EDI transactions are still in the store-and-retrieve or store-and-forward mode. Also known as interactive EDI.

Research, Development, Test, and Evaluation: RDT&E

Request For Quotation: RFQ

Solicitation Mailing List Application (SF-129): A standard form used by the Federal Government to collect information about contractors and to add them to solicitation mailing lists. Information is collected by individual procurement offices. In most cases, the SF-129 form is being superseded by the EDI 838 contractor registration process.

Service Contract: A contract that calls directly for a contractor's time and effort rather than for a concrete end product.

Shared Data Warehouse: SDW

Simplified Acquisition Procedures (SAP): the methods prescribed in FAR Part 13 for making purchases of supplies or services.

Simplified Acquisition Threshold (SAT): $100,000, except that in the case of any contract to be awarded and performed, or purchase to be made, outside the United States in support of a contingency operation (as defined in 10 U.S.C.101(a)(13)) or a humanitarian or peacekeeping operation (as defined in 10 U.S.C.2302(7) and 41 U.S.C.259(d)), the term means $200,000.

Small Purchase: A purchase for no more than $100,000.

Solicitation: To go out to prospective bidders and request their response to a proposal.

Solicitation Mailing List: SML

Source Selection: The process wherein the requirements, facts, recommendations, and government policy relevant to an award decision in a competitive procurement of a system/project are examined and the decision made.

Source Selection Authority (SSA): The official designated to direct the source selection process, approve the selection plan, select the source(s), and announce contract award.

Source Selection Evaluation Board (SSEB): A group of military and/or government civilian personnel represents functional and technical disciplines. The board is charged with evaluating proposals and developing summary facts and findings during source selection.

Source Selection Plan (SSP): Proper planning in source selection is essential to assure fairness and timely selection of the most realistic proposal. Preliminary planning activities include preparation of the acquisition plan, draft request for proposal (RFP), and formal RFP, as well as the SSP. The SSP is written by the program office and approved by the source selection authority (SSA). Typically, the SSP consists of two parts. The first part describes the organization and responsibilities of the source selection team. The second part identifies the evaluation criteria and detailed procedures for proposal evaluation.

Specification: A document used in development and procurement which describes the technical requirements for items, materials, and services including the procedures by which it will be determined that the requirements have been met. Specifications may be unique to a specific program (program-peculiar) or they may be common to several applications (general in nature).

Standard Industrial Classification (SIC) Code: An industrial classification method used to report price index changes. A code number is assigned to specific industry groups.

Statement of Objectives (SOO): That portion of a contract that establishes a broad description of the government's required performance objectives.

Statement of Work (SOW): That portion of a contract that establishes and defines all non-specification requirements for contractors efforts either directly or with the use of specific cited documents.

Trading Partner: A business that has agreed to exchange business information electronically. Describes any business that has been registered to conduct business electronically with the Government. As the Government implements EC/EDI, these Trading Partners will receive the bulk of Government procurements. Your should note that this term is also used in the commercial market place.

Value Added Networks (VANs): Generally a commercial entity (similar to a long distance telephone company, or a computer on-line service) that provides communications services, electronic store and forward mailboxing, and other related services for EDI transactions. VANs are necessary because it would be too expensive and impractical to establish direct point-to-point connections with all of your trading partners. VANs are also useful because they are accessible to you regardless of physical location, support reliable connectivity to your trading partners via varying communications speeds and protocols, provide security for your transactions including audit trails, and generally offer other value added service features and ANSI X12 EDI translation software.

Value Added Service (VAS): An entity that provides services beyond communications to its customers. These services may range from translation and segregation of the data to complete turnkey business systems support for customers.

Vendor: An individual, partnership, corporation, or other activity that sells property to the military establishment. A vendor may supply a government contractor.

Weighted Guidelines: A government technique for developing fee and profit negotiation objectives, within percentage ranges established by regulation.

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APPENDIX B: PROCUREMENT DESKTOP-DEFENSE (PD^2) FUNCTIONALITY

A. OVERVIEW

The software application used in the Standard Procurement System (SPS), Procurement Desktop-Defense (PD^2), provides acquisition document formation and management functions. This appendix describes the layout of the PD^2 desktop (refer to Figure 8), the system administration functions and the PD^2 functions. [Ref. 52] Table 15 provides details of the reference notation used in Table 8.

B. DESKTOP

The PD^2 desktop software provides an intuitive Microsoft (MS) Windows-based interface that is easy to learn, and offers a variety of the following common features: [Ref. 52]

- Document storage and management in intuitive cabinets and folders that mimic the user's physical office
- Ability to access, view, and edit multiple documents at the same time
- Integrated to share information with other Windows-based office automation tools, including MS Word, Excel, and other OLE-compliant products
- On-line routing, review, and approval of all documents
- Full Print and Print Preview capabilities for all required procurement and contracting forms
- User-maintainable vendor and organization databases
- On-line reference library (FAR/DFARs updated within 14 days of publication in the Federal Register)

- Complete audit trail, with a log of all actions performed, as well as unsuccessful attempts to perform functions

- Integrated ad hoc and management reporting through the Cognos Impromptu and PowerPlay tools

- Comprehensive workload management and tracking, including PALT assignment, various reporting tools, and a user-controlled automatic assignment engine

- Complete on-line documentation (User Guides & Glossary)

- Fully compliant with Year 2000 requirements

C. SYSTEM ADMINISTRATION

The functionality of PD^2 is process-driven. Through the System Administration module, users can tailor PD^2 to match their own business processes. System Administration features include: [Ref. 52]

- Total control of User IDs and profiles, including security rights, authorized warrant(s), approval authorities, team cabinet access, preference settings, management authority, and other features

- Control of the clause database and clause selection logic for all types of procurements; ability to add local clauses and selection rules

- Ability to create and maintain standard templates to control the business process, including approval chains, milestone plans, check lists, contract distribution lists, and standard review and approval routes

- Ability to create and maintain standard document templates for commonly used documents such as a SOW, J&A, Acquisition Plans, etc.

- Control of procurement-related settings for functions such as document validation rules, class set-aside lists, and other features.

D. PD^2 FUNCTIONS

The prototype of PD^2 was designed based on input from acquisition professionals that proposed 299 required characteristics and resultant changes to the American Management System, Incorporated, (AMS) off-the-shelf product. However, because of the complexity involved with so many changes, AMS and the user group prioritized these functions and only incorporated 85 characteristics into Version 3.5. [Ref. 49] The following lists the functions of the nine phases of PD^2: [Ref. 52]

1. Requirement Definition

Version 3.5

- Standard PR form to support all types of requirements
- Funds commitment tracked per line item or per overall requirement
- Automatic transfer of line item and other data to solicitation and award phases
- Forms and templates for various supporting documentation, such as CDRLs (DD1423), DD254, MIPRs, SOW, J&A, etc.
- Automatic validation of PR data against user-selectable edit rules
- Automatic user notification upon receipt of requirement package
- "Copy PR" feature to quickly fill out new requirements from previous examples
- Full PR modification functionality for changes to requirements
- PR cancellation and retention in accordance with FAR 4.705
- Government Cost Estimate tracking within the PR document
- Comprehensive workload assignment and tracking for all requirements

2. Presolicitation

Version 3.5

- Milestone planning module with automatic data fill-in and auto-notification of approaching milestones
- Access to milestone plans and status through workload tracking and reporting
- Warnings when previous milestone tasks in overall process are not complete
- Auto-notification if a requirement is on a class set-aside list or is exempt from Buy American
- Integrated Correspondence Log for tracking E-mail, letters, and other communications
- Automatic creation of Solicitation Mailing Lists through Vendor Rotation or other sources
- CBD Announcement generation and tracking (sources sought through award notification); auto-creation of Block 17 (description)

Version 4.0

- Automatic recommendation of a contracting type
- "Smart Attachments" -- automatic filling of data from the procurement database into user-defined word processing templates (letters, custom forms, plans, etc.)

3. Solicitations/Amendments

Version 3.5

- Automated PIIN numbering of all solicitations and amendments
- Complete CLIN/subCLIN/ELIN functionality, with Global Change and Copy capabilities
- Solicitations integrated into single, formatted MS Word document that can be E-mailed, printed, posted to worldwide sites, etc.

- Clause incorporation through "clause templates" based on user-defined criteria

- Automatic fill-in of the "Table of Contents" on cover sheet (SF33)

- Automated "Refresh" of clauses in a solicitation when clause updates occur in the database

- Combine multiple requirements on one solicitation, or split a requirement to multiple solicitations/awards

- "Attach" new requirements to an existing solicitation at any point in the process

Version 4.0

- Automatic clause selection based on user-definable selection rules, and data contained in the PR and/or solicitation

- Automatic notification when data changes in solicitation require a change in clause inclusions

- Automatic creation of Table of Contents for Section J and inclusion of identified attachments

- Automated validation of solicitation data against user-selectable edit rules

4. Evaluation/Source Selection

Version 3.5

- Offer Evaluation module receives and tracks multiple offers per solicitation, multiple offers per vendor, and allows evaluation by vendor or by line item

- Price analysis feature for comparison of previously awarded prices by NSN, FSC, description, etc.

- Print/View SF1409 Abstract of Offers from Offer Evaluation module

- Continuous tracking of Bids, No-Bids, and No Responses

- Automatic "Purge" feature from SML for user-specified number of No-Responses to solicitations
- Automatic notification of late offers
- Automatic notification if vendor eligibility changes
- Offer Evaluation form automatically fills data in DD1155 and SF1449

Version 5.0

- Integrated tracking of non-price factors in large purchase evaluations; expanded capability to track various cost and price positions during negotiations
- Automatic recommendation of a determination of responsibility
- Creation and transmission of DD1547 data

5. Award

Version 3.5

- Automatic PIIN numbering of all award documents
- Ability to award simplified acquisitions, large purchases, commercial items, BPAs, and deliver/task orders -- against local or "External" contracts
- Document "Generation" feature converts award from individual pieces of data into a single, formatted MS Word document
- Electronic Data Interchange (EDI) support for ANSI X12 850 transaction (version 3050), for all types of awards
- Funds validation and approval before obligation can be made
- DD350 and DD1057 reporting

Version 4.0

- Automatic award generation for user-specified NISH, FPI, FSS, UNICOR, or IDIQ-type requirements
- Construction and A&E awards (SF1442 and SF252)

- Automated validation of award data against user-selectable rules
- Support for awards in foreign currencies
- Pre-award survey forms
- Enhanced IDIQ functionality to support task order tracking for dollar value ceilings

6. Award Administration

Version 3.5

- Automatic PIIN numbering of all modifications (PCO & ACO)
- Support for "concurrent mods" (multiple modifications in progress at once), with all modifications updated when one is "released"
- Delivery Orders and Task Order tracking and reporting
- Electronic Data Interchange (EDI) support for ANSI X12 860 transaction (version 3050), for all types of modifications
- Audit Tracking module
- Dispute Tracking (Protests, Claims, REAs, Appeals) module
- Vendor Performance Tracking module
- Automatic generation of "Summary of Changes" for modification
- Termination functionality for awards or individual line items

Version 4.0

- Ability to apply one modification across multiple contracts
- Automated validation of modification data against user-selectable edit rules
- Enhanced modification feature to allow "stand alone" modification document with Summary of Changes only

Version 5.0

- Government Furnished Property module
- Expanded Vendor Performance tracking to aggregate performance data from multiple awards

7. Receipt/Acceptance

Version 3.5

- Ability to identify and track delivery dates as fixed dates or ADCs throughout process
- Entry and tracking of shipping, inspection, and acceptance terms by line item
- Automatic incorporation of delivery data (dates, ship to, inspection and acceptance, etc.) in generated solicitation, award, and modification documents

Version 4.0

- Integrated Delivery and Payment module for tracking of vendor delivery and performance
- Automatic generation of an initial delivery schedule, based on contract data
- Automatic conversion of delivery dates to firm dates from award
- Track approvals of first article or production lot test results
- User-defined auto alerts based on delivery schedule and data

Version 5.0

- Receipt and transmission of MILSCAP transactions
- Ability to tie CLIN deliveries to Cure Notices, Corrective Action Plans, etc.

8. Payment

Version 3.5

- Tracking of all obligated amounts for awards by contact or by individual CLINs/subCLINs
- Ability to enter and track payment terms as part of Offer Evaluation module
- Entry and tracking of final payment date to support auto-closeout functionality

Version 4.0

- Integrated Delivery and Payment module entry and tracking of payment schedule and terms
- Automatic calculation of payment amounts per item, based on terms and conditions
- Payment request/authorization process for tracking individual payments
- Validation of payment requests against Variation in Quantity allowances

9. Closeout

Version 3.5

- Tracking of all obligated amounts for awards by contact or by individual CLINs/subCLINs
- Ability to enter and track payment terms as part of Offer Evaluation module
- Entry and tracking of final payment date to support auto-closeout functionality

Version 4.0

- Integrated Delivery and Payment module entry and tracking of payment schedule and terms
- Automatic calculation of payment amounts per item, based on terms and conditions

- Payment request/authorization process for tracking individual payments
- Validation of payment requests against Variation in Quantity allowances

Version 5.0

- Tracking and disposition of Government Property
- Integrated contract archiving capability

Table 15. SPS Reference Notation

Menu/function	Notation
I. Procurement	Proc
A. Requirements>	Rqmnt
1. PR Form	PR
2. Copy PR	
3. MIPR (DD 448)	MIPR
4. Security (DD 254)	
5. CDRL (DD 1423)	CDRL
6. PR Modification	
7. Release Modification	
B. Pre-Award/Award>	PA/A
1. Solicitations>	Solic
a. Solicitation Mailing List	SML
b. IOQ (DD form 1707)	
c. RFQ (SF 18)	RFQ
d. RFP/IFB (SF 33)	
e. Commercial Solicitation (SF 1449)	
f. Construction Solicitation (SF 1442)	
g. Release Solicitation	
h. Amendment (SF 30)	Amendment
i. Commercial Solicitation Amendment (SF 30)	
j. Release Amendment	
k. Pre-Award Survey>	PA Survey
1. General (SF 1403)	
2. Technical (SF 1404)	
3. Production (SF 1405)	
4. Quality Assurance (SF 1406)	
5. Financial (SF 1407)	
6. Accounting System (SF 1408)	
2. Offer evaluation	
3. Certify Funds>	
4. Awards>	
a. Simplified Purchase (DD Form 1155)	

Table 15. SPS Reference Notation (continued)

Menu/function	Notation
b. BPA Master Agreement (DD Form 1155)	
c. Imprest Fund Disbursement	
d. Large Purchase (SF 26)	
e. Commercial Purchase (SF 1449)	
f. Construction Purchase (SF 1442)	
g. Architect-Engineer Contract (SF 252)	
h. External Award	
i. Automatic Ordering	Auto Order
j. Release Award	
5. FPDS Reports>	
6. Audit Tracking	
7. Vendor Dispute Tracking	
C. Post Award>	
1. Modification (SF 30)	
2. External Award	
3. Release Modification	
4. FSS Order/DO/TO (DD Form 1155)	
5. Commercial DO (SF 1149)	
6. BPA Call	
7. Imprest Fund Management	
8. Award Status	
9. Vendor Performance	
10. Audit Tracking	
11. Vendor Dispute Tracking	
12. Closeout>	
13. Termination>	
14. Contract Data Cover Sheet	CDCS
15. Delivery>	
16. Discrepancy Report>	
17. Payment Request	
18. Payment	
D. Milestone Plan	Milestone
E. Checklist	
F. CBD Announcement	CBD
G. Correspondence>	
H. Attachment	
I. EDI Transmit	EDI
J. Reports	
K. Workload Management	Workload
L. User Workload	
II. Reference Menu	
A. NAVSUP	
B. NAPS	
C. WWW sights	
D. FAR	
E. DFARS	

Table 15. SPS Reference Notation (continued)

Menu/function	Notation
III. Utilities Menu	Util
A. Document Import	
B. Document Export	
C. Word-processing	
D. Spreadsheets	
E. Alerts>	
F. System Administration>	SA
1. Approve	
2. Attach	
3. Buy USA	
4. CDL Temp	
5. Checklist	
6. Class	
7. Clauses	
8. Closeout	
9. EDI	EDI
10. Funds	
11. Groups	
12. Milestones	
13. MOD Banner	
14. PALT	
15. PR Analysis	
16. Preferences	
17. Procurement Profile	
18. Recant	
19. Reports	
20. Route	
21. Set Asides	
22. Teams	
23. Transmit	
24. Unit of Issue	U/I
25. User	
26. User Type	
27. Warrant	
G. Organization Management	
H. Preferences	
I. Issue Tracker	
J. Toolbar	
K. Help	

Source: Adapted from [Ref. 52].

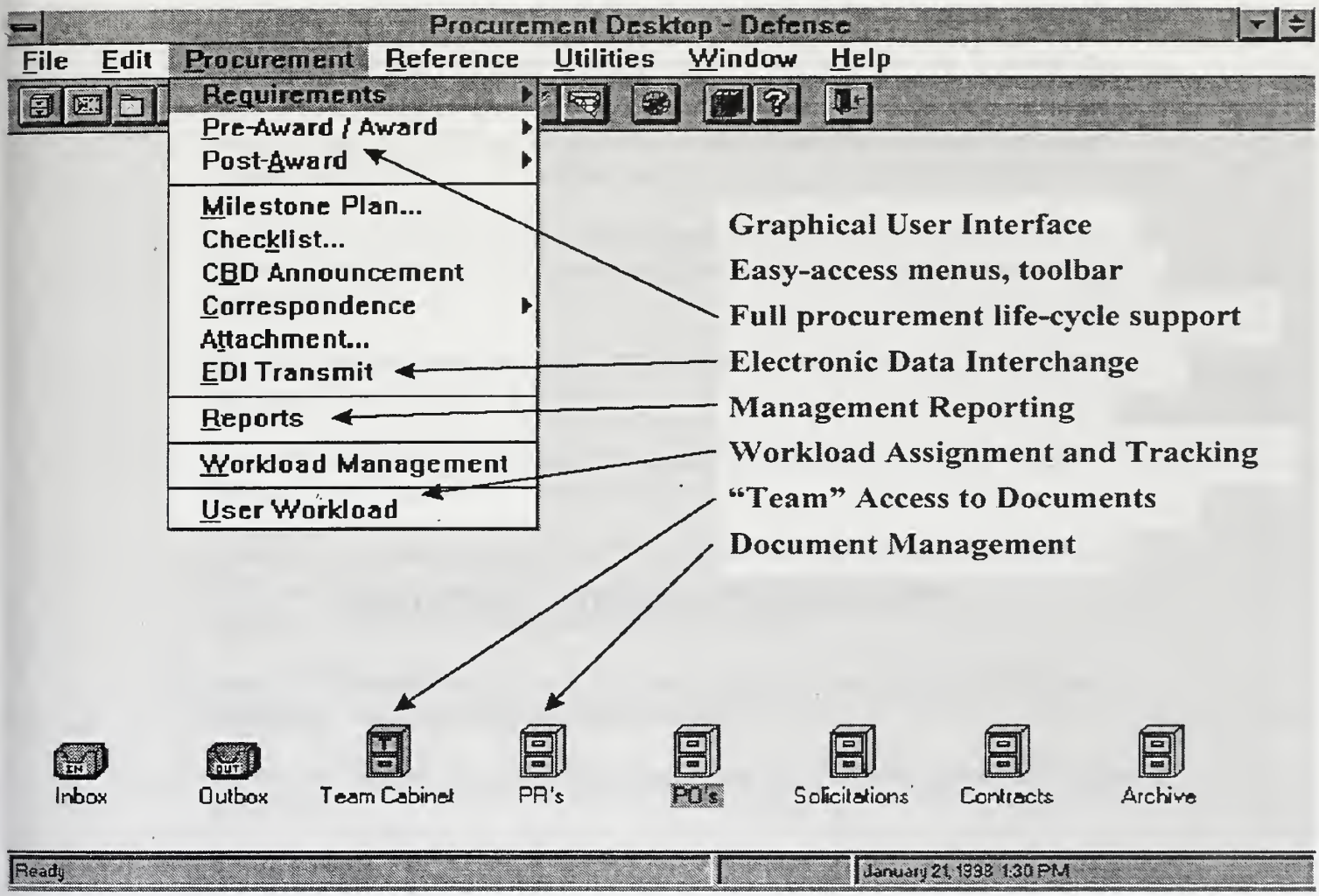

Figure 8. PD^2 Desktop [Ref. 53]

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